U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT

EUGENE DISTRICT OFFICE

LAKE CREEK AQUATIC HABITAT MANAGEMENT PLAN

AND ENVIRONMENTAL ASSESSMENT OR-090-00-20

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PRELIMINARY FINDING OF NO SIGNIFICANT IMPACT

EA NO. OR-090-00-20

The Coast Range Resource Area, Eugene District, Bureau of Land Management, has completed an Aquatic Habitat Management Plan (HMP) and Environmental Assessment for aquatic habitat managed by the District in the Lake Creek watershed, Siuslaw River basin, western Lane County, Oregon.

The design features of the Proposed Action and Alternatives are described in the Environmental Assessment OR-090-00-20. Project work would improve the quality of aquatic and riparian habitat in the Lake Creek watershed. The Proposed Action is an update of an HMP prepared in 1987 and partially implemented. The update is in response to the completion of the Northwest Forest Plan and Spotted Owl Supplemental EIS and the Eugene District Resource Management Plan and Record of Decision. The Proposed Action is fully consistent with the objectives and management recommendations in the Eugene District RMP and ROD, and the Aquatic Conservation Strategy in the Northwest Forest Plan.

Based on extensive experience in the Lake Creek Basin, on aquatic habitat management elsewhere in the Siuslaw River Basin, and on the evaluation of similar projects and management activities in other locations, no significant adverse impacts are expected to: Flood plains or wetland/riparian areas, wilderness values, cultural resources, prime or unique farmland, wild and scenic rivers, air quality, Native American religious concerns, invasive non-native species, environmental justice or water quality. Following consultation with the U.S. Fish and Wildlife Service it was determined this action would not jeopardize the continued existence of any federally listed terrestrial species known to occur in the vicinity. All proposed actions are consistent with the description and terms and conditions for aquatic and riparian restoration projects in the National Marine Fisheries Service Biological Opinion of 4 June 1999 for the Coastal Coho Salmon.

Determination

On the basis of information contained in the EA, and all other information available, it has been determined that the Alternatives analyzed will not have significant environmental impacts not already addressed in the Eugene District Resource Management Plan and Record of Decision, and do not constitute a major Federal action affecting the quality of the human environment. Therefore, and

Environmental Impact Statement is not necessary and will not be prepared for this proposal.

DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT
EUGENE DISTRICT
LAKE CREEK AQUATIC HABITAT MANAGEMENT PLAN

ENVIRONMENTAL ASSESSMENT NO. OR090-EA-00-20

PURPOSE AND NEED

The Lake Creek Aquatic Habitat Management Plan (HMP) covers lands administered by the Eugene District, Bureau of Land Management, in the Lake Creek Basin above and including Deadwood Creek.

Lake Creek is a major tributary of the Siuslaw River, western Lane County, Oregon. The creek arises on hills bordering the Willamette and Alsea River basins, flowing in a generally westerly direction. Larger valleys are now primarily settled, and managed for agriculture and residential purposes. Smaller tributaries and adjoining hills are forested, and managed primarily for timber-related values. Land ownership is a mixture of Federal, state and private.

Lake Creek is a major producer of anadromous and resident salmonids. Numbers of fish produced in the basin has varied, but in recent years declined to levels where one species, coho salmon, is Federally listed as threatened. Declines are a result of multiple factors, including changes in habitat.

In 1987, the Eugene District of the Bureau of Land Management prepared an Aquatic Habitat Management Plan (HMP) as part of efforts to increase the potential for production of anadromous salmonids from the Lake Creek basin. Many recommendations in the 1987 HMP were implemented. Several updates and supplements have been prepared that tier from the original HMP. Changes in land management on Federal lands as a result of the 1995 Eugene District Resource Management Plan (RMP) and Record of Decision (ROD) and monitoring of past restoration activities are sufficient to propose the updating of the 1987 HMP. This updated HMP covers the same geographic area as the original 1987 HMP.

Watershed Analysis (WA) for Lake Creek was completed in 1996 by the Eugene District, Bureau of Land Management. Deadwood Creek was not included in the Eugene District Lake Creek WA Deadwood Creek tributaries administered by the Eugene District are included in the Indian-Deadwood Watershed Analysis completed by the Siuslaw National Forest and Eugene District BLM. Information from both watershed analyses are included in this HMP.

OBJECTIVES

1. Improve aquatic habitat for resident and anadromous aquatic species by increasing channel complexity, retention of structural and substrate materials, and development and maintenance of a

diversity of habitats.

2. Improve and maintain channel stability and hydrologic processes.

3. Improve and maintain water quality and natural sedimentary processes.

4. Improve and maintain migratory routes by removing barriers to movements of aquatic species.

5. Increase the availability of large conifers in riparian areas as future sources of stream structure and wildlife habitat, and improve and maintain integrity of riparian vegetation communities.

BACKGROUND

Lake Creek is divided into two sections by a falls just below Triangle Lake. A large fault-block slipped into the canyon, forming a large lake. Most of the original lake filled in with sediments eroded from adjoining hills leaving a flat valley. Triangle Lake is a remnant of the original lake. Four types of habitats are found in the upper basin. In addition to Triangle Lake, Hult Pond provides standing water habitat. Streams crossing the Triangle Lake valley flow over alluvial deposits. Gradients are low and the channel and banks dominated by small particle materials. At the margins of the lake, streams have moderate gradients with intermediate size particles and a pool-riffle channel. In the headwaters, streams are steep, boulder-bedrock dominated channels with smaller pools and pool-rapid-cascade habitats.

Below Lake Creek falls Lake Creek flows westward in an unconfined valley. A series of tributaries enter Lake Creek, with the larger flowing from the north. The tributaries show variation in their gradients and channel configurations. The streams begin on steeper headwall areas, flow through canyons of variable width, then cross a flatter floodplain before entering Lake Creek.

Triangle Lake and the Lake Creek valley were settled beginning in the the middle 1800s. Larger valleys have been converted to domestic and agriculture activities. The smaller tributaries and adjoining slopes are managed for forest products, and are in a mixture of age classes but dominated by younger age classes of conifers. Streams once dominated by woody material and beaver dams lost much of the structure that created productive fish habitat. Fish runs, particularly coho salmon, have declined, with loss of habitat being one of many factors involved in the decline.

Beginning in 1984 the Eugene District began a series of habitat improvement projects (See Appendix C for a list of projects) designed to improve stream channel habitat, increase access to additional habitat, improve water quality and hydrologic processes, and modify riparian vegetative to increase large conifers for future use as riparian and stream woody structure.

Monitoring and evaluation of restoration activities show that many of the desired results were reached although only a portion of the 1987 HMP was actually implemented. Since the HMP was initiated, land uses have changed and restoration capabilities increased. This HMP describes changes proposed to the original HMP.

EXISTING ENVIRONMENT

Location

The Lake Creek Watershed is located northwest of Eugene in the Coast Range Mountains of western Lane County, Oregon. The watershed is within the Coast Range Province established by the Northwest Forest Plan. The watershed in 94 percent forested and 6 percent non-forest vegetative type, the latter consisting primarily of agriculture/pasture and residential areas. The communities of Alpha, Greenleaf, Blachly, Horton, and Triangle Lake are within the watershed.

Ownership

The Lake Creek watershed covers approximately 68,772 acres. BLM manages 31,863 acres (46.3%), Forest Industry Companies 15,995 acres (23.3%), Other private owners 12,824 acres (18.6%) and the State of Oregon 8,090 acres (11.8%).

The Deadwood watershed covers approximately 43,262 acres, of which BLM manages 5,558 acres (13%), the U.S. Forest Service 28,918 acres (67%), State of Oregon 1,358 (<1%), and private 7,428 (17%)

Forest Plan Allocations

Under the Northwest Forest Plan the following land use allocations were made on BLM lands:

LAND USE ALLOCATION	TOTAL ACRES	PERCENT
Late Successional Reserves	24,726	45.4
Marbled Murrelet Reserves	359	0.1
Known Owl Habitat Area	856	0.2
Connectivity	1,104	0.2
Riparian Reserves	16,078	29.2
General Forest	11,379	20.8

The interim Riparian Reserves use a site potential tree height of 210 feet. The Riparian Reserves in the table are based on this width. Two ACEC/ONA areas are designated under the Eugene Resource Management Plan at Lake Creek Falls and the wetlands in the upper area of Hult Pond.

Climate

The watershed has a maritime climate characterized by mild temperatures and prolonged cloudy/overcast periods, wet winters, relatively dry summers, and a long frost free growing season. The temperatures are relatively mild with narrow diurnal fluctuations. Winter temperatures average 42 degrees F with average daily minimum temperature being 35 degrees. Occasional periods of below freezing occur. In summer the average temperature is 64 degrees F with the average daily maximum temperature being about 76 degrees.

The precipitation ranges from 62 inches in the Nelson Creek area to 114 inches on Prairie Mountain, with the majority of precipitation occurring between October and April. Rain is the primary form of precipitation, although snow does occur occasionally but does not persist. The precipitation generally results from low pressure weather systems that approach from the Pacific Ocean on the dominant westerlies. The cold weather patterns that produce snow and/or freezing rain events originate out of the gulf of Alaska. The summers are characterized by fair, dry weather for extended periods of time produced by high pressure systems that result from the shifting of the storm tracks to the north.

Geology

The Lake Creek basin is located in the Coast Range Mountains, which are composed primarily of the Flournoy Formation, thick beds of sandstone with minor sequences of siltstone. The range is uplifting along a generally north-south line. In addition to the gradual uplift, the Coast Range is subjected to periodic catastrophic seismic activity centered on the edge of the Juan DeFuca Plate. A southwest-northeast fault has also been identified east of Triangle lake.

Intrusive rocks, of basaltic composition, are found in the vicinity of Prairie Mountain, Windy Peak and Elk Mountain, and the southern boundary of the watershed. More resistant to erosion, the volcanic intrusive rocks are often found at higher elevations. Basaltic rock is harder and more persistent when exposed in the stream channel, and is a major contributor of larger boulders. Otherwise, the silt and sandstone weathers to produce finer particle materials with limited amounts of gravel or larger rock.

About 43,000 years ago, a large block of sand and siltstone slipped off Little Elk Mountain into the Lake Creek canyon, blocking Lake Creek, and forming a large lake. Most of the lake has filled in with sediments of clay, sand, silt and gravel, leaving Triangle Lake, a remnant of the once much larger lake. Alluvium of Holocene and Pleistocene Age is deposited along Lake Creek, and along its main tributaries above Triangle Lake.

The soils range from shallow to very deep, from nongravelly to very gravelly, and from fine textured to coarse textured. The more productive soils are typically deep, reddish clay loams/clays with less than 15 percent coarse fragments.

The watershed is in an area of active uplift as the Coast Range increases in height. The rate of uplift varies throughout the watershed. The active uplift contributes to the general instability in the watershed.

Five geomorphic units have been identified in the basin:

1. Covering 12.3% of the watershed, Unit #1 consists of terraces and flood plains along Lake

Creek and larger tributaries. This unit is composed of geologically recent alluvial deposits of unconsolidated sand, silt, and gravel forming flood plains and filling channels of present streams. In places this includes talus, slope wash, soils containing abundant organic material, and thin peat bogs.

2. Covering 43.4% of the watershed, Unit #2 consists of gentle to moderate topography with relatively low drainage densities and deep soils. Landslide evidence is infrequent and contribution to the stream system is minimal. Most of the erosion and subsequent sediment to the stream system is composed of fine-sized material.

3. Covering 37.3% of the basin, Unit #3 is underlain by competent, massive Tyee sandstone/siltstone with an abrupt transition to the overlying shallow to moderately deep soils. Sharp ridges with steep, uniform sideslopes from the ridgetop to the valley bottom characterize this area. The landscape is sharply dissected by numerous stream channels that may become extremely steep in the upper reaches. Translation landslides and debris torrents appear to be a dominant factor in shaping the landscape and contributing sediment to the stream system.

4. Covering 6.7% of the basin, Unit #4 is underlain by an igneous intrusion that is more resistant to weathering, and probably is the reason this area has higher elevations than its surroundings.

5. Covering 0.3% of the basin, Unit #5 is composed of landslide and debris-flow deposits (Holocene and Pleistocene), unstratified mixtures of adjacent bedrock.

Hydrology

The Lake Creek watershed has approximately 609 miles of perennial streams, while Deadwood/Indian has 360 miles of perennial fish streams. Lake Creek above Deadwood Creek and Deadwood Creeks are both 6th order stream. Below Deadwood, Lake Creek becomes a 7th order stream. Over half the total stream miles are in the small, first order streams.

The average flow per square mile of Lake Creek watershed is greater than for the Siuslaw River watershed as a whole due in part to greater elevation in the headwaters and greater precipitation in Lake Creek. Lake Creek contributes 35% of the flow of the Siuslaw River at Mapleton. Triangle Lake dominates the hydrology of Lake Creek below the lake. Flow out of the Triangle Lake Valley is predominantly through Triangle Lake. Because of the large water storage capacity of the valley above the lake and the damming effect of the canyon blockage, flows downstream are moderated, with lower flows during peak precipitation events and higher flows during subsequent dry periods as stored water flows out of the upper basin. Hult Pond provides a similar but much reduced water storage function for upper Lake Creek.

Elsewhere in the watershed, water storage is limited. The sedimentary rock is not permeable and has little capacity to store or move groundwater. Alluvial materials in the valley floors and upslope soils provide most of the limited storage capacity. As a result, streams exhibit high flows in response to storm events and very low flows during extended periods without precipitation.

Vegetation

The current forest community lies within the western hemlock-western redcedar zone, with the dominant conifers being hemlock, cedar and Douglas-fir. Yew and grand fir are also present. Hardwood species include red alder, bigleaf maple, chinkapin, madrone and Pacific dogwood. Oregon white oak is present in the Triangle Lake valley, a remnant of past burning practices by Native Americans. However, replacement of oak is almost non-existent and the species is disappearing from the valley as older trees die. Since the last ice age, the forest community has changed from vegetation adapted to a drier, cooler climate to the current hemlock-cedar- Douglas-fir community.

The shrub and ground cover species associated with these forested plant communities are varied and plant associations have not yet been developed for the watershed. Common shrubs include vine maple, willow, hazel, oceanspray, salal, Oregon grape, elderberry, rhododendron and nine-bark. A variety of ferns, forbs, and other ground cover species are also present within the area.

Unique vegetation communities are generally associated with ponds, swamps, marshes, wet and dry meadows, grassy balds, rock habitat and mineral deposits. The Triangle Lake Valley frequently floods during periods of precipitation, creating extensive wet meadows and wetlands. Additional wetlands were created when log ponds were built earlier in this century. Observations suggest that plant diversity is high for these areas. Limited botanical inventories have been conducted. Several Special Status plants are present, but none are currently listed as threatened or endangered.

Extensive areas of grasslands are present in the Triangle Lake Valley and along Lake Creek and its major tributaries. In the Triangle Lake Valley burning by Native Americans probably helped maintain the grassland-wetland-oak community. Valley bottoms along Lake Creek and major tributaries were probably mixtures of forest, wetlands and open areas. With removal of large wood from the stream channels, the channels were downcut, lowering water tables and reducing the development of wetlands. Many of these valley areas are now managed for grazing, agriculture and residential use.

Riparian communities are dominated by red alder and big leaf maple. Willow has become increasingly common along larger streams. Large conifers that may serve as a source of large wood are very sparse. As a result of the development of extensive road networks and past human activities, the riparian areas are frequently fragmented, with heterogeneous plant communities dominated by hardwoods.

Vegetation communities were modified by periodic fires set by humans or of natural origin. These fires resulted in a mosaic of forest patches in various seral stages. At the time of European settlement, approximately 40% of the forest was in a climax condition. Fire intervals varied over time as climate patterns changed.

Wildlife

Approximately 280 non-fish vertebrate species are found in the watershed. Of these, 35 species are considered Special Status species. Two species, the marbled murrelet and northern spotted owl, are listed as Federally threatened or endangered. Amphibians, otter, beaver and mink are the non-avian vertebrate species most closely associated with water.

Stream Channels

Historically the stream channels in the watershed were dominated by large wood. Boulders are limited in distribution, being found mostly in streams like Greenleaf Creek and upper Lake Creek associated with igneous intrusions. Headwaters, which constitute 50-70% of the stream miles, are steep areas of active erosion, a response to the continuing uplift of the Coast Range. The stream bottoms on the larger streams are depositional, with wetland characteristics. As a result of active removal of large wood, most of the larger stream channels show active secondary incision into the valley floors, which reduces the ability of the valley floors to store groundwater and streams to store sediments. As a result, the streams show reduced habitat complexity, fewer deep pools, and reduced spawning area. Stream channels in most tributaries are degraded to some degree. With limited large wood available in riparian areas as near-term structure, natural recovery is not expected to occur for decades.

Human Activities

Native Americans utilized the resources in the basin for at least 9000 years. There is no indication that they utilized permanent habitations, but, instead, moved depending on season and availability of resources.

The first settlers of European origin established homesteads beginning in the 1860s. Most settled along the major creeks such as Lake Creek. Small communities, such as Horton, Blachly, Greenleaf, Deadwood, and Triangle Lake are scattered throughout the watershed. The construction Highway 36 in 1925 reduced the isolation. The highway, along with a railroad to Triangle Lake, brought people attracted by the recreational activities.

Recreational activities on BLM land within the watershed are varied. Lake Creek Falls is a popular recreation site. Much of the watershed is in the Upper Lake Creek Special Recreation Management Area (SRMA), consisting of 15,000 acres. Plans for the SRMA are in development. Recreation, such as OHV use, hunting, fishing and camping are mostly dispersed but the Recreation Management Plan in preparation designates locations for recreation facility development.

The main economic activities in the watershed are farming and timber harvesting. Harvesting of timber began in the 19th century, and initially involved hi-grading of stream bottoms. Logs were floated to one of four ponds above Triangle Lake or downstream below the lake. As improved equipment made the harvesting and transport of logs more feasible, logging extended into previously unharvestable areas. As a result of timber management and fires, only limited amounts of climax forest communities remain in the watershed.

Fisheries

Anadromous fish present in Lake Creek are: Chinook salmon (Oncorhynchus tshawytscha), coho salmon (O. kisutch), steelhead trout (O. mykiss), searun cutthroat trout (O. clarki) and Pacific lamprey (Lampetra tridentata). Until a fish ladder was built at Lake Creek Falls in 1989, all anadromous fish except the lamprey were blocked from the upper basin. Lamprey were able to pass over the falls. Now anadromous fish have access to all major streams in the basin.

Access to some streams in the basin are secondarily limited by natural and human-caused barriers. Little Lake and its tributaries represent the largest habitat areas not accessible to anadromous fish. Natural falls in Greenleaf Creek limit access to the upper 2/3 of that basin. Genetic testing done for BLM by the Cooperative Fish Unit (now USGS) at Oregon State University indicated that cutthroat trout above the falls in Greenleaf maintain a distinctly different genetic make-up when compared to cutthroat trout farther downstream.

Native resident fish include cutthroat trout (O. clarkii), brook lamprey (L. richardsoni), sculpins (Cottus sp.), redside shiners (Richardsonius balteatus), and speckled dace (Rhinichthys osculus). Other native resident species, such as peamouth (Mylocheilus caurinus), pikeminnow (Ptychocheilus oregonensis) and large scale sucker (Catastomus macrocheilus) are present in lower Lake Creek and may be found in the HMP area at least part of the year.

Non-native species have been introduced into Triangle Lake and Hult Pond, including centrarchids (Lepomis sp., Micropterus sp.) and bullheads (Ictaluris sp.). The introduced species have become established in the lakes but not the stream. While on occasion the introduced species, particularly bullheads, are seen in Lake Creek below Lake Creek Falls, winter flows and cold temperatures appear to prevent them from establishing breeding populations.

Other Species

Very little information is known on non-fish aquatic species. Giant Pacific salamanders (Dicamptodon tenebrosus) are widespread and sometimes numerous. Crayfish are also widespread but numbers vary. One population of freshwater mussels is also present, but appears to be limited to the Triangle Lake outlet. Red-legged frog (Rana aurora) and tailed frog (Ascaphus truei) have both been observed in the watershed. While no inventory has been done specifically for these frogs, both, particularly the tailed frog, appear to have declined during the past 16 years.

Osprey, eagles, and blue herons are present along the streams. Dippers have been observed during inventories, particularly in Greenleaf Creek, but they also appear to have been reduced in numbers in recent years. Water fowl are common, particularly on Hult Pond and Triangle Lake. For a number of years geese nested at Hult Pond, but have not been seen in recent years. Beaver were common and widespread but have also declined during the past few years as trapping has increased. Otter and mink, present but less numerous, are also being taken by trappers.

PROPOSED ACTION

The Aquatic Conservation Strategy in the NW Forest Plan and the Eugene District RMP and ROD are designed to maintain and enhance the condition of the aquatic system and associated aquatic communities. The NWFP and RMP direct preparation of a watershed analysis for each Fifth Field watershed in which the District has management responsibility. The watershed analysis summarizes the existing conditions in the watershed and opportunities for management by BLM on Federal lands. The watershed analysis for Lake Creek was completed in 1995, for Indian/Deadwood in 1996. This version of the Lake Creek Aquatic Habitat Management Plan is designed to update the existing 1987 version, and to incorporate the recommendations and options described in the watershed analysis. The Lake Creek and Deadwood Watershed Analyses identified several opportunities for improving the aquatic system. These include:

1. Placing structures into the stream channel to improve hydrologic function and create habitat.

2. Regulate flows from Hult Pond.

3. Control sediment generation and routing, and reduction in erosion.

4. Create wetlands and other special habitats.

5. Increase the amount of large wood in stream channels.

6. Increase the amount of large conifer in riparian areas to improve shade and bank stability, and to create a future source of large woody structure.

7. Improve passage for movements of salmonids and other aquatic species.

The opportunities identified in the watershed analysis are consistent with the objectives in the Aquatic Conservation Strategy, and are consistent with the objectives in the 1987 Lake Creek Aquatic Habitat Management Plan and subsequent project-specific modifications.

The following methods for implementing the Lake Creek HMP update are based on monitoring and evaluation of completed restoration activities in the Lake Creek watershed, experience with other restoration activities in the Siuslaw River, and restoration activities by other organizations and in other river basins. For convenience the methods are broken into categories although one or more categories of restoration activity may be done in an individual stream. All proposed projects are designed to conform with the Standards and Guides in the NWFP and Eugene District RMP.

1. <u>Culvert and Bridge Rehabilitation</u>

Culverts may create barriers to the movements of anadromous fish and other aquatic species, and contribute to modifications in natural hydrologic processes that may create flood and erosion hazards. Four types of rehabilitation are proposed in the Lake Creek Watershed.

a. Removal. Culverts are removed and not replaced. The removal involves digging out and lifting the culvert. The site where the culvert is removed is shaped and stabilized to reduce the potential for erosion.

b. Replacement. The existing culvert is removed by digging out and lifting from its location in the streambed. The culvert is replaced with a round culvert, a half-arch culvert or a bridge. The choice of replacement will depend upon the flows at the site and the need to provide for movement of anadromous fish and aquatic organisms up and downstream. Preference will be given to replacements that provide for a natural bottom and gradients that permit passage. Where steeper gradients are required, modifications to the culvert or bridge, such as baffling, will be included in the design. Design of the culvert or bridge includes conformance with approved standards for flow. Because many of the existing culverts do not meet current standards for flow, larger structures may be required. Additional excavation may be needed to accommodate a larger structure or a structure of a different type. Mitigation measures will be taken as needed to reduce the potential impacts of erosion during replacement work. Excavated areas will be stabilized and protection provided as needed to reduce the potential for erosion.

c. Improved access. For culverts creating a barrier to movements of anadromous fish and other aquatic organisms where removal or replacement are not feasible, access to the culvert may be created or improved by placement of structural material in the channel below or above the culvert. This structural material will be primarily logs and boulders placed to elevate the stream channel and/or create pools to facilitate movement into the culvert and into the stream above the culvert. Short-term disturbance of the stream channel and stream bank may occur as a result of accessing the channel with construction equipment and materials. When feasible, placement of materials will occur from the road or bank, but may require working within the stream channel. Steps to reduce erosion and other impacts are discussed under stream channel.

d. Improved culvert passage. When culverts are too steep to permit passage and either replacement or removal are not feasible, passage through the culvert may be facilitated by placement of baffles, weirs, or similar type structures in the culvert. This breaks up velocity barriers and provide resting places for the fish and other aquatic organisms.

e. Bridge Replacement. The bridge at Hult Pond is proposed for replacement. The current bridge would be removed, including the footings. New footings would be dug that would widen the pond outlet channel, improving the control of water moving through the outlet. New footings would be installed and the new bridge built on the footings.

2. Channel Structure

Channel structuring involves placement of materials in the channel to raise the channel elevations and to increase the complexity of habitat in the channel. Materials used are primarily boulders, logs, stumps, rock and gravel. All these structural materials do enter the channel naturally but currently levels of delivery are inadequate. Sources of trees for channel structure have been greatly reduced as a result of past human activities. Boulder and rock delivery, particularly of the harder, more persistent volcanic material has always been limited, but landscape changes, particularly construction of roads, has reduced delivery further. Structure designs used in channel structure projects are based on observations of existing structural features occurring naturally in the system, and on structures previously developed by the Eugene District, other BLM Districts, or other agencies. Designs have multiple purposes. Proposed structures are designed specific to a location, and take into account existing flow patterns, channel and riparian features.

In the past gabions have been used as a major structural material. They are effective but have a limited life span. Under specific circumstances the use of gabions or other materials may be considered.

Materials may be delivered to designated sites at the project location well in advance of project work and stockpiled at the project site, or they may be delivered to the site at the time they will be used, reducing the need for stock-piling and handling. Materials storage sites are designated and appropriate plant and animal clearances completed prior to the stockpiling of any materials.

Creation of structural features may utilize some hand work or horses, but primarily involves use of heavy equipment or aircraft to deliver and place the materials. Two processes are involved; the delivery of materials from a source or stockpile, and the placement and securing of the materials in the stream channel. Smaller hand-built structures of wood and rock have been placed in small to medium (3rd-5th order) streams. Materials are often already on-site or can be carried into the channel by hand or horses. Most of the proposed structures covered by this HMP utilize larger structural materials and require other mechanical methods to move into and place in the stream channel. Movement requires development of some type of trail or access into the stream and the distribution and placement of materials in the stream channel.

Once in place, the larger structural materials are generally anchored to the substrate using cables and epoxy or other materials such as rope or rebar. Smaller logs, rock and gravel may be left unanchored and allowed to move in response to the current. Because of the lack of natural retention features in most of the stream channel, many of the materials, particularly logs and stumps placed in the channel, would move out of the river system if not anchored. Once anchored, they create collection points to retain placed material or materials entering the channel from adjoining slopes. Four methods are proposed for moving and locating the structural materials.

Movement of Materials

a. Heavy equipment. Structural materials for most project work would be delivered to the channel and placed in position in the channel using excavators, front end loaders or similar equipment.

Temporary accesses are created leading from existing roads through the riparian area to the channel. Most access routes will be under 200 feet in length, and are generally located in areas where riparian vegetation restoration is planned, and will be sub-soiled after project work is completed to create planting sites. The development and rehabilitation of the access routes are designed to reduce the potential for erosion and channel disturbance, and in many locations utilize existing older roads and accesses.

In the stream channel, the equipment may move for short distances up or downstream from the point of entry. Where appropriate multiple structural elements are placed using a single entry in order to reduce the amount of disturbance to the riparian area. Typically stream substrates in project areas are dominated by bedrock. To the degree possible, existing structure in the stream is protected and incorporated into the projects. Materials may be delivered to the channel by one piece of equipment while the second carries out actual project construction to reduce the amounst of time for channel disturbance. Time needed for construction of a project ranges from one or two hours to three days. Equipment is removed from the channel when work is not in progress.

b. Aircraft. Several project locations are a kilometer or more from the nearest developed road. In order to reduce the disturbance from road construction, it is proposed to deliver and place structural materials utilizing helicopters. Structural materials would be stock-piled at a nearby landing location and ferried to the project site and lowered into place. Channel disturbance occurs during the dropping of the logs, stumps or other materials. Once in place materials may be anchored using cable and epoxy. Stock-pile sites utilize existing roads for delivery of materials to the project area. Existing lands are used to sort and organize the structural materials. Helicopter servicing is conducted at a site near the project area. Because of the size of clearing needed, these are typically developed sites or sites with recent vegetation removal along existing roads.

c. Horse Placement. In some of the smaller streams in the project area, especially where access for equipment is limited, structural materials may be delivered to the site and placed in the channel by hand and/or by horses. Only minor path development would be required. Materials may be taken from adjoining slopes, or stockpiled at a nearby site.

d. Hand Placement. Hand-built structures are of small logs and boulders, most taken from the immediate area. Boulders are usually in the channel, and are moved to a new location to create larger structures. Most commonly, wood is either conifer or alder logs created during thinning. The logs are transported by hand, small winch systems, or horses, and are placed into structures.

<u>Beaver</u>

Beavers can provide important habitat components, particularly in creating large pools and refuge areas. One beaver release project has already been undertaken in the watershed, with beaver introduced. At the same time, active beaver trapping has removed beaver from some of the most sensitive habitat areas. It is proposed to work with State wildlife managers for cessation of trapping on public lands in the HMP area and to continue to utilize opportunities to increase the size and distribution of the beaver population.

Project Design

Several types of channel structures are proposed. The structures are placed in combinations in and along the channel. Structures may be placed individually, but in most projects are clustered along the stream channel. Design depends upon the existing conditions and potential of the site. The designs vary according to the objects at a particular site. Emphasis may be on creating pool or spawning habitat, nursery and off-channel areas, increased cover, increased water storage, or retention of wood and mineral materials moving down the stream channel. Designs utilize existing stream patterns in an individual location. The following descriptions are for the general types of structures used.

a. Weirs. Weirs are full-spanning structures of logs, boulders and/or stumps that extend completely across the stream channel. The weirs may be a single log or line of boulders, or complexes of logs and/or boulders. They extend up the bank to protect against erosion around the end of the weir. The height and length depend on the individual site conditions. The weirs are designed to raise the stream bed, creating an area of deeper water and sediment deposition upstream. The design of the weir can also be used to control the movement of water both up and downstream of the weir. Larger boulders or logs may be left without anchoring, but the majority of weirs require cabling or other anchoring to prevent them breaking apart.

b. Cascades. Cascades function similar to weirs in raising the upstream channel elevation. They are constructed of boulders, logs and rock, with the highest point at the upstream end. The front face slopes downstream in a typical cascading pattern. While the cascades are predominantly boulder, diversity and stability is provided by large logs. Smaller logs may be added for cover Smaller rock and gravel are added to fill pore spaces around larger boulders. The design and dimensions are based on similar natural structures found in the Siuslaw river system. The largest boulders are used as key stabilizers and are not generally anchored. Some of the other key logs and boulders in the cascades are anchored to improve stability. Other materials are not anchored and are allowed to shift in response to high flows. The cascades are larger in size with more complexity than weirs, and are designed to increase the stability of the structure and to increase the diversity of habitat, particularly for invertebrates and amphibians.

c. Sills. Sills are most often individual logs or a log and small boulder structure spanning most or all of the stream channel. They are generally anchored either by being embedded in the stream channel or by cable or rebar. They are designed mostly to maintain the level of a stream channel, particularly where channel stabilization is need to retain spawning gravels.

d. Jetties. Jetties are structures of boulders, logs and/or stumps extending from the bank into the channel but not spanning the channel. They are designed to re-direct flow and to create diverse habitats along the margins of the channel. Materials may extend up on the bank. Anchoring depends on site requirements.

e. Ramp logs. Ramp logs are logs with one end up on the bank and the other end extending into the channel. They leave a space under the log next to the bank where the stream can interact to create side pools or other habitat. The logs are generally anchored to keep them in place.

f. Log and boulder placement. Individual or clusters of logs, boulders, and/or stumps are placed in the channel in various positions to break up flows, create small islands, and increase habitat diversity. They may be placed in the middle or on the sides and in a variety of configurations. They are most often used to provide cover or channel diversity, especially in locations where full spanning structures are not suitable. Materials may be anchored, depending on the size of boulders, logs or stumps and the potential for natural retention in the channel.

g. Rock and gravel placement. Because of the limited delivery of hard rock and gravel to the stream channel, they may be placed in the channel to facilitate development of salmonid spawning areas and habitat for other species. Rock is usually placed by equipment into the channel at the structure site. Gravel is usually placed in the channel above the locations where it is needed, and the current used to distribute the gravel to the structures.

3. Riparian Restoration

The purpose of riparian restoration is to increase the percentage of conifers in the riparian area as a future source of large woody material in the channel, increase bank stability and shading, and to create snags and woody debris in the riparian area. Riparian zones are currently dominated by red alder, with some big leaf maple and mixed-age conifers. Restoration efforts are planned primarily for brushy areas without trees and the red alder-dominated communities. All in-channel projects include provisions for riparian restoration at both the access routes and adjoining riparian areas.

As stated in the Aquatic Conservation Strategy, "Active silvicultural programs will be necessary to restore large conifers in the Riparian Reserves. Appropriate practices may include thinning densely-stocked young stands to encourage development of large conifers, releasing young conifers from overtopping hardwoods, and reforesting shrub and hardwood-dominated stands with conifers." Experience within the watershed and by others working on riparian restoration has shown that removal of over-story trees and brush control are important to establishing conifer in the riparian area.

In developing accesses from existing roads into the stream channels, routes are selected that facilitate riparian restoration. Red alder along the access routes are removed, with the downed trees placed in nearby riparian areas or in the stream channel. Once the stream channel project work is completed, the access routes are subsoiled to create suitable conditions for planting of trees. Additional red alder may be removed in patches adjoining or away from the access routes in nearby riparian areas to reduce shading and create planting sites. Brush may be removed from additional adjoining sites. The sites where trees and brush are removed away from the access routes are not usually subsoiled. Trees are felled using chain saws or other hand equipment, or are girdled and allowed to die and fall over time. Brush is generally removed using heavy equipment or by hand in areas where trees are felled or girdled. Conifers and larger big leaf maple are preserved wherever possible. Where younger conifer are present, competing vegetation may be removed to release the conifer.

Stands of second growth conifer adjoining streams may be identified for thinning. This may be done as part of a larger thinning that includes upslope trees, or as a separate riparian thinning. Trees thinned in the riparian area may be used as in-channel habitat, or retained in the riparian area as woody material. Riparian conifer thinning follows standard silviculture documentation and procedures. Thinning or riparian stands of red alder may also be conducted as part of riparian vegetation restoration.

During the subsequent planting season, usually the winter months following site preparation, trees are planted in the prepared riparian locations. Species for planting include Douglas fir, red cedar and western hemlock, depending on the site conditions and proposed species mix. Trees are tubed to reduce browsing. Competing vegetation is controlled by placing mats around the trees, or by brushing during subsequent years.

4. Road Stabilization

Several options are identified for addressing problems to the aquatic system created by roads. The road network that extends throughout the Lake Creek HMP area is a mixture of roads managed by BLM, the State of Oregon, Lane County, U.S. Forest Service, and private land owners. Frequently multiple users have rights of way on existing roads. Options for addressing problems in the aquatic system due to roads depends on decisions made cooperatively by the agencies, companies and individuals that control or use a particular road segment. In fiscal year 2000, the Eugene District initiated preparation of a Transportation Management Plan for the Lake Creek watershed. Any actions involving road modifications would be consistent with the final TMP. Some of the options for modification of roads to reduce hydrologic impacts include:

a. Surfacing of roads. Roads, particularly those used in wetter periods, may be surfaced with rock or paved to reduce the potential for silt entering the aquatic system.

b. Improved drainage. In addition to modifying culverts, drainage may be improved by water-barring, providing sub-surface drains, improving ditching, or other steps that would reduce erosion hazard, reduce water interception, and reduce hazards for slope and fill failure. Road cuts and fills may be treated to reduce erosion and potential for slumping.

c. Limit access. Access may be restricted as to the types of activities, and to times of the year when access may be permitted. This may be done by using signing, gating, barriers, administrative limitations, or other methods.

d. Road closure. Roads may be barricaded to limit access, subsoiled and planted, or reshaped by moving road fill so that the land surface more closely resembles natural contours.

5. Flow Management

The Lake Creek Watershed Analysis recommends managing flows from Hult Pond. Hult Pond does have a drainage pipe but otherwise the flow is uncontrolled over the outlet. BLM erected a fish ladder at the outlet that does not change the pond level but at low flow does control whether the water flowing through the outlet passes over the outlet sill or through the fish ladder. The adjustable gate at the head of the fish ladder will continue to be managed to facilitate up and downstream migrations of fish.

6. Educational Opportunities

Lake Creek Falls and Fish Creek are a designated Watchable Wildlife Site primarily for the opportunity for the public to see migrating and spawning salmon and steelhead. Currently, there is an interpretive sign at Lake Creek Falls, and a short seasonal trail along part of Fish Creek for use by the Oregon Trout Salmon Watch program. Lower Greenleaf Creek is also used by Salmon Watch. People also use the Fish Creek Road bridge over Lake Creek to view chinook which often use the pool under the bridge for holding.

As part of the Lower Lake Creek recreation plan, additional educational developments were identified. These include:

a. Placement of stream structures in Lake Creek at the old powerhouse site, approximately one-half mile downstream from the Lake Creek Falls fishway. The structures would be designed to increase spawning habitat for chinook, and possibly coho, to improve the opportunity for viewing spawning salmonids.

b. Development of a trail along Lake Creek in the old powerhouse area for use by the public for viewing salmon. The trail would be handicapped-accessible.

c. Construction of an interpretive trail along Fish Creek. The trail would facilitate viewing of spawning salmonids. In addition, interpretive signs would be place along the trail to provide information on riparian communities, stream habitats, restoration activities, and land management. Parking and signing would be placed on an old landing at the downstream end of the trail, which would run approximately one mile to an existing road maintenance aggregate storage area. The trail would be located primarily in the riparian area. Most of the trail would utilize existing old road and access routes.

ALTERNATIVES TO THE PROPOSED ACTION

1. No Action

Under a No Action Alternative, no additional actions would be taken to increase stream structure, replace culverts, restore riparian areas or stabilize roads specifically for the benefit of aquatic resources. Educational opportunities are included in the Lower Lake Creek Recreation Plan EA and consultation documents. Culvert and road work already occur as part of the district road maintenance program. The Transportation Management Plan will evaluate existing roads and culverts and may recommend modifications beyond existing maintenance. Under the No Action alternative, no stream channel restoration would be done, and riparian restoration would be primarily associated with vegetation manipulation carried out for other purposes.

2. Partial Implementation of Proposed Actions

The Proposed Action Alternative describes a variety of options for culvert, stream channel, riparian, and road restoration work for Lake Creek and its tributaries in the watershed. Individual projects may be implemented separately. The HMP proposes to implement the proposed actions over a period of ten years, but the actual implementation schedule depends upon the availability of financial and personnel resources. Under the Partial Implementation of Proposed Actions, a portion of the Proposed Actions identified in the HMP would be implemented but the remainder would not be implemented.

ANALYSIS OF IMPACTS

Proposed Action

All proposed actions would require some disturbance of the road right of way, riparian zone or stream channel. All actions are in locations that have been previously disturbed by management activities. The extensive existing road network provides access for most locations for which activities are proposed. No new semi-permanent or permanent roads would be created as a result of the proposed actions, although temporary accesses would be needed for movement of equipment and materials from existing permanent roads to restoration sites in the riparian and stream channel. During past restoration activities in the Lake Creek Watershed, up to 90% of the accesses used for implementing riparian and in-channel projects utilized older existing access routes. Where available, existing access routes and roads would be utilized for access into and through the riparian area. All temporary accesses and most of the existing access routes that would be utilized for project work would be rehabilitated and revegetated after project work is completed.

The primary immediate impacts of the proposed actions are the potential reduction in riparian vegetation, transitory increase in sediment production, disruption of riparian soils, and disturbance of aquatic communities. Timing of the work during low water periods, maintenance of buffers around work in riparian areas and on-site steps to control erosion are used to limit potential impacts. The longer-term impacts of the proposed actions are to increase the available aquatic habitat, increase the supply of large conifers, improve passage for fish and other aquatic species, and reduce potential for erosion.

Clearances for sensitive, proposed, listed or survey and manage plant and animal species will be completed prior to any on-ground work and any necessary adjustments made to the plan to protect species located during clearances. If any sensitive, proposed, listed or survey and management plant or animal species is found in the project area the proposed project will be modified or canceled. Accesses, project activities and timing of project work will take into account potential impacts on wildlife, such as spawning and nesting periods. The primary impact to wildlife is expected to be disturbance from operation of heavy equipment in riparian areas and the stream channel. The disturbances would be short-term.

As a result of the placement of structures in the stream, water surface levels would be raised at all flow levels, with the degree of flow increase depending on the type and size of structure. During peak flows more water would flow into riparian areas. While erosion is expected to increase as a result of project activities in the riparian and in-channel, project designs reduce the potential erosion. The flooding of riparian areas provides a positive benefit for deposition of silts in riparian areas and increased groundwater infiltration, and for increased feeding opportunities for aquatic species. Previous stream projects that have raised water levels have resulted in an increase in wetlands in the adjoining riparian area. The projects are expected to contribute to an overall improvement in water quality and reduced flooding downstream.

1. Culvert Rehabilitation. Culvert removal or replacement requires excavating around the existing culvert and lifting the culvert from the stream channel crossing. Additional excavation may be required to accommodate a larger replacement culvert or bridge. The primary impact is the temporary, transient increase in siltation resulting from excavation and movement of the culvert site, and the placement of the new culvert or bridge materials. The amount of potential sediment production is reduced through measures that may include working during low flow periods, use of interceptors such as silt fences, temporary storage of excavated materials away from the active channel, interception and diversion of stream flows, and protection of exposed fill through mulching, brush placement or hardening. Pulses of sediment are most likely to occurr during the initial and final stage of work, but are usually short - a matter of a few hours. Monitoring of past culvert projects showed that the amount of sediment entering the stream channel was small enough that no detectable accumulations occurred downstream and there was no demonstrable impact on fish based on their observed behaviour.

Hult Bridge replacement impacts would be the same for the culvert replacement except that the bridge spans the outlet and not a stream channel. No salmonids are present in the channel during the summer; the outlet is used in fall and spring for migration into and out of the upper basin. No impacts on fish are expected as a result of the bridge replacement activities.

2. Channel Structure. While some channel structure placement may be done from existing roads, most require improving existing secondary access routes or development of temporary access from existing roads into the stream channel. The access is used for moving machinery and materials from the road into the channel. Delivery of materials (logs, stumps, rock and boulders) may require multiple trips, usually with a rubber-tire vehicle. Actual work in the channel is generally done with a track vehicle,

which make a single entry into and out of the channel. In previous channel structure project work, most of the access routes through the riparian zone followed existing old roads or trails. Where such old roads or trails are present, they will be utilized in lieu of developing new access routes. The old access routes are generally old roads, skid trails or log haul routes, which are covered with brush and/or alder. Where no existing access route is present, one may be pioneered from the road to the riparian area and stream channel. The development of these accesses usually involve removal of some vegetation, and may include movement of soils. Some disturbance to vegetation and soils occurs as a result of the development and use of access routes. Where compaction of soils occurs, the access routes are subsoiled after completion of the project work to break up the compaction and prepare the site for planting. Following completion of project work, the access routes are rehabilitated to reduce potential erosion, using boulders, logs and vegetation to protect the surface until new plants gorw, and trees are planted along access routes and adjoining areas to both rehabilitate the access routes and increase the future source of large woody materials. Ground vegetation, primarily of rapidly growing annuals and perennials, begins regrowing within months of the completion of project work.

Within the stream channel, the machinery moves for variable distances up and down the channel to place the logs, boulders, and smaller rock delivered to the channel. The movement and placement of materials may disrupt the channel bed and banks, producing a transient increase in silt at the project location. Most project activities at a single site are completed in a matter of hours although large structures, primarily the large river cascades, may require up to three days to complete all aspects of the project activity. In most project locations bedrock is the dominant substrate, reducing potential impacts and silt production from project activities. Work is completed during low flow periods, and very little sediment is transported from the project area downstream. No mortality of salmonids has been observed from channel structuring activities,
although some mortality of sculpins and invertebrates has been seen. Salmonids frequently return to the project site within hours after completion of project work. Disturbance to banks is controlled by using a limited number of access points, using accesses that require less disturbance, placement of logs and boulders along the banks, and designing the structures to reduce the impact of project activity. Disturbed banks are protected through placement of boulders, logs or brush at the time machinery is removed from the creek.

In the longer term the channel structure alters the complexity of stream habitats. The structures are expected to raise the elevation of the stream channel, increase deposition of gravels and other sediments, increase retention of woody material generated upstream, and to increase the amount of pool and nursery habitat. Channel changes occur during peak flow periods, with structures designed to interact with peak flows and sediment movement during these flow periods.

Design of structures are based on natural log and boulder structures in the Siuslaw Basin, but of necessity approximate function rather than architecture. Natural log jams relied on large trees with rootwads falling into the channel. Such trees are no longer available in most riparian or immediate upslope areas. Most wood used in projects is from other locations (in Eugene, nearly all from blowdown salvage and road rights of way), which must be transported on public-use roads. This limits logs to a length of fifty feet or less. Because of limited natural boulders delivery, they are also brought into the stream channel to augment existing boulders. The materials used would be prone to moving out of the project area if not stabilized on site. Key log and boulder structure elements are cabled to prevent them from washing away during high flows and to increase stability of the structure. The anchoring of larger structural logs also reduces the potential damage to downstream culverts, bridges and property. In the absence of cabling very few structures would remain following peak flows. Some smaller logs or boulders are not anchored and are allowed to shift on their own; most become incorporated in the structures.

The Eugene District has been implementing restoration structures for thirty years. Experience has shown that gabions, while effective, have an average lifespan of 10 years. The gabions usually break apart in the middle, but the ends remain along the side of the channel for many years often providing additional habitat. Hand-built structures have a survival span of one to more than 15 years. They tend to be very effective in smaller streams. Boulder structures built 15 years ago remain in place and fully functioning. The larger log and boulder structures have been used for a shorter period of time, but have a retention rate of 70 to 95%. One set of log and boulder structures in Fish Creek had a survival rate of 95% even with a major flood and the presence of large amounts of sediment and debris in the flood waters. Natural wood in similar reaches of Fish Creek suffered considerable loss during the same floods. Some bank erosion has occurred with the larger channel-spanning structures. This appears due to eddies set up by the structure rather than lack of adequate amounts of boulders. Designs are continually being adjusted as a result of monitoring and evaluation in order to address this and any other unanticipated responses of the stream to habitat structure.

Stream structuring utilizing helicopters would not require development of accesses into the stream. Staging of materials would occur on existing roads and landings. Material would be transported by air directly to the stream channel. Short-term disturbance of the stream channel would occur as a result of the placement of logs, boulders, and stumps, with an attendant transient increase in silt. Longer term impacts from the increase in structural materials in the stream channel would be similar to those from channel structuring using machinery.

Stream structuring done by hand or by horse may entail developing an access trail, but disturbance to vegetation and soils would be very minimal. Channel disturbance to aquatic communities and the production of sediment during in-channel work would also be minimal and has not been seen to create problems for aquatic organisms.

Anchoring of logs, boulders and stumps with epoxy and cable is done by hand in already disturbed project locations and does not entail additional disturbance to the site although there may be some additional brief disturbance of aquatic organisms in the immediate vicinity of the drilling and cabling. Cabling would be necessary in most structuring in order to retain materials onsite and in a functional pattern.

Deadwood Creek and Lake Creek to the mouth of Congdon Creek are listed as 303(d) limited streams. Deadwood is listed for habitat modification and temperature. Because of the limited ownership along Deadwood Creek BLM does not propose project activity other than activities which may be done cooperatively with other land owners. Project activities would cause a transient increase in sediment. Both the availability of habitat and temperatures would be improved as a result of channel project activities.

Lake Creek is listed as 303(d) limited for temperature. Measurements of temperature by BLM in Lake Creek above Triangle Lake found no temperatures that exceeded limits for salmonids. No projects are proposed for Lake Creek between Triangle Lake and the mouth of Congdon Creek. Temperatures in Lake Creek below Triangle Lake are strongly influenced by Triangle Lake. Because the only outlet for Triangle Lake is over the falls, the surface temperature in the Lake controls water temperature flowing over Lake Creek Falls. Further downstream, tributary inflow moderates water temperature in Lake Creek. Water temperatures from the Lake exceed standards for salmonids for about six months of the year. Temperatures decline during the winter and spring, the primary period for migration of salmonids. The Lake Creek Falls ladder project has no impact on water temperatures. BLM manages no lands on Lake Creek below the mouth of Fish Creek, so any projects would be cooperatively with other land owners. Projects would be expected to improve both habitat availability and water temperatures.

Proposed channel projects are designed to improve groundwater flow by increasing the groundwater storage capacity of the watershed.

3. Riparian Restoration. Most riparian restoration projects are designed to be undertaken at the same time as channel structuring although several projects have been done in the same area but independent of channel structuring activities. Accesses for channel structuring are developed in locations where riparian restoration is proposed. Following completion of channel structure project work the accesses are subsoiled to prepare them for planting. Machinery and hand cutting may be used to remove additional red alder and brush along the access routes to create larger, more open planting areas. Additional planting areas may be opened to reduce overstory trees and understory vegetation using hand tools. Removal of overstory trees would increase the amount of sunlight reaching planted areas. If not adequately thinned, retained trees, particularly red alder and big leaf maple, have the potential for an increase in lateral branching following removal of trees, partially to completely filling the overstory openings over time. Because only patches of trees in various spacings are removed from the riparian area to create planting sites, impacts on riparian vegetation and climatic conditions are limited. Because of retention of riparian vegetation on the side of the stream opposite the planting sites, and a minimum 25 foot no cut buffer along the stream on the side where planting will be done (other than at access points), the stream itself receives little additional sunlight. The limited monitoring on previous projects detected no change in stream temperature. Riparian travel corridors would be maintained. Microclimate conditions along the stream remain similar to pre-project conditions.

Over time, it is anticipated the percentage of riparian areas in conifer would increase. Growth of planted conifers is accelerated through use of standard silviculture practices such as tubing to reduce browsing and control of competing vegetation. Impacts on vegetation communities resulting from silvicultural practices are similar to those in other forest units. In the long term, planted conifers are expected to provide a source of seed for re-seeding adjoining unplanted areas, facilitating further the restoration of conifer stands along the streams.

4. Road Stabilization. Direct impacts on streams from road stabilization activities are minor, and are limited primarily to a potential transient increase in silt entering streams. In the long term, it is anticipated that the road stabilization will reduce siltation into the streams, and will improve hydrologic functions of the basin by reducing water interception, routing into channels, and loss of water from groundwater storage. By retaining more of the goundwater in the subsurface flow patterns, the availability of groundwater to vegetation would be increased and downstream flooding effects decreased as a result of reduced road water interception. Barricading or closing of roads also reduces traffic in riparian areas, together with associated impacts on water quality and aquatic communities.

5. Flow Management. No change is expected in flow management at Hult Pond except for the widening of the outlet channel associated with replacement of the bridge so no change in impacts is expected.

6. Educational Opportunities. Lake Creek Falls and Fish Creek are designated Watchable Wildlife areas primarily for observing migrating and spawning anadromous salmonids. Fish Creek and Greenleaf Creek are used by Salmon Watch for educational opportunities. The proposed action would includes some channel restoration to increase spawning habitat in the Watchable Wildlife area, improve access for viewing fish and increase informational displays. Channel restoration for spawning habitat would have the same procedures and impacts as other Channel Structuring described above.

Improved access would involve providing trails for educational access. The proposed trails, as described under the proposed Lower Lake Creek recreation plan are in Riparian Reserves, but would use existing trails or roads except for a short distance along Fish Creek. Improving the current accesses for use as trails would facilitate use by more people but would also help to control areas used by visitors. Interpretative signs and parking would be in currently disturbed areas and would not require any additional clearing of vegetation other than removal of some brush. The educational opportunities would cause minimal impact on the riparian reserves. The main potential impact would be an increase in visitors to the Watchable Wildlife area with a potential for increased disturbance to the fish.

Proposed Schedule

The Lake Creek HMP is designed as a multi-year plan. Many of the projects were first identified in the 1987 Lake Creek Aquatic HMP but were not completed due to lack of funds. Completed projects are described in Appendix C. Depending on funding, implementation may occur over a period up to ten years. The amount of work done and the location of the work in any year will depend upon the availability of funding. Initial project work described in this HMP update is planned for 2000, and represents a continuation of the type of roject work started under the 1987 Plan. Since the project work is being done in cooperation with several partners, scheduling of some work will depend on the capacity of the partners to do restoration activities. Project locations are separated throughout the basin facilitating the scheduling of individual project on different time schedules.

Alternatives to Proposed Action

1. No Action Alternative

Under the No Action Alternative, none of the proposed actions would be carried out as part of an aquatic restoration plan. Some actions, such as culvert rehabilitation or road stabilization may be performed as part of other programs such as road maintenance. No additional structuring would be carried out in the stream channel. Any riparian restoration would be done in association with silvicultural activities. Analysis conducted as part of the RMP process anticipates gradual recovery of riparian areas and stream habitat over time as a result of implementation of the Aquatic Conservation Strategy guidelines, but that recovery would require one hundred years or more due to the absence of available larger conifer trees in riparian areas that could provide a source of in-channel woody material.

2. Partial Implementation of the Proposed Action

Impacts of individual actions would be the same as for the Proposed Action. The difference would be in scope, with fewer positive or negative, short or long term impacts.

UNAVOIDABLE AND ADVERSE IMPACTS

No Unavoidable Impacts have been identified for the Proposed Action.

Adverse Impacts include a transient increase in sediment from culvert rehabilitation, road stabilization and channel structuring; a reduction in overstory vegetation in riparian areas during riparian site preparation and planting, disturbance of fishes and invertebrates in the stream channel during culvert rehabilitation and channel structuring, temporary disruption or closure to recreational trail or road use, and disturbance to wildlife as a result of the operation of heavy equipment.

SHORT TERM VS LONG TERM IMPACTS

Short Term impacts include the transient increase in silt production, reduction of overstory riparian vegetation and disturbance to aquatic and terrestrial organisms.

Long Term impacts include the increase of conifers in the riparian areas, reduction of silt, improved passage at culverts with a reduction in the potential for road failures, reduced human impacts in riparian areas, an increase in channel complexity, an increase in availability of habitat for all native aquatic species, an improvement in water quality, increased stream channel and riparian complexity, and improved hydrologic function.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No Irreversible or Irretrievable Commitment of Resources have been identified.

MITIGATING MEASURES

The following mitigating measures have been identified:

1. Scheduling of all work during the year would be in accordance with guidelines issued by the Oregon Department of Fish and Wildlife and U.S. Fish and Wildlife Service.

2. Inspection and maintenance of equipment would be required to reduce the potential for leakage of petroleum products into the stream. When working next to or within the stream channel spill kits would be provided.

3. Where depth or channel conditions warrant, a by-pass would be used to intercept stream flow and by-pass the water around the work area. The potential for siltation in the water would be reduced through use of silt fences, mulching, or other sediment control measures as needed, based on site conditions. Banks and exposed slopes would be armored sufficiently to prevent erosion.

4. All heavy equipment shall be cleaned prior to contract work to slow the spread of noxious weeds. Staging areas and stockpile areas shall be free of noxious weeds.

5. Prior to initiation of project work notification would be given of potential road delays or closures. Appropriate safety procedures would be used to control traffic in project areas involving roadways used by the public.

MONITORING AND EVALUATION

All channel project locations are inventoried prior to implementation of project work. A photographic and descriptive record is made of all culvert, channel structure and riparian restoration projects. Channel structure and riparian restoration projects are located using GPS for inclusion in the District

GIS data system. Juvenile fish sampling is conducted in selected habitats prior to project work using seining, electrofishing and/or snorkeling. For project areas used by anadromous salmonids, spawning counts have been conducted for up to 12 years to provide a baseline. Following completion of project work, the projects are visited and photographs taken to compare with conditions prior to project work to show projects in place prior to exposure to peak flows. Subsequent photographs are taken to document changes in the structures, riparian areas or other projects. Spawning ground counts are continued in the established index area. Juvenile sampling, using snorkeling and electrofishing, is used to document use of structures. Information is also collected on non-salmonid fish species both before and after project work. Reference macroinvertebrate samples are also collected at some project sites. Tree survival and growth are documented in riparian restoration areas during at least the first five years following planting.

CONSULTATION AND COORDINATION

The Proposed Action would have no impacts on local air quality, prime or unique farmlands, environmental justice, Native American religious concerns, hazardous or solid waste, or wilderness.

1. Private Lands. Under the Oregon Coastal Salmon Restoration Initiative and Authority provided to BLM by the Wyden Amendment, BLM has agreed to cooperate with other land owners in development and implementation of aquatic habitat restoration. Potential projects on lands owned by Roseburg Forest Products are identified in the list of potential projects. A Memorandum of Understanding signed by Roseburg Forest Products, Oregon Department of Fish and Wildlife, and the Eugene District provides for cooperative restoration activities. In discussions between the Eugene District BLM and Roseburg Forest Products, it was agreed that BLM would identify potential restoration opportunities on lands owned by Roseburg Forest Products. This plan, with identified opportunities, will be discussed with Roseburg Forest Products in order to identify situations where coordinating work on both private and federal lands could be done more efficiently than having restoration work done as separate projects. Cooperative projects have been conducted in the watershed with other private landowners. Additional projects on private or state lands, as identified, may be brought forward for discussion with the land owners of potential cooperative efforts. These cooperative efforts are expected to be done directly with the land owner or through the Siuslaw Watershed Council.

A portion of the Lake Creek Watershed is shared with the Siuslaw National Forest. The Eugene District BLM and Siuslaw National Forest are cooperating in development of a joint restoration effort to be implemented under this plan.

Discussions have also been held with the Oregon Department of Fisheries and Wildlife, and with Lane County Roads on potential cooperative projects. Opportunities exist for cooperation with other private land owners or state agencies to participate in restoration activities.

2. Sensitive Species. BLM has completed an inventory of resident and anadromous fish species on Federal lands within the project area that are listed or are candidates for listing under the Endangered Species Act. Initial Survey and Manage species inventories for species included in the SEIS ROD have begun. Prior to beginning on-ground project work on an individual project, BLM will complete all required plant and animal consultation, conferencing, and protocol clearances. In the event a sensitive species is present, the individual proposed project will be modified or excluded as required in order to protect the identified sensitive species.

The coho salmon in the watershed is listed as a threatened species. Restoration activities included in this Plan are consistent with the description for aquatic habitat restoration activities and the associated terms and conditions, as included in National Marine Fisheries Service June 4, 1999 Oregon Coast Province Programmatic Biological Assessment and Biological Opinion for Oregon Coastal Coho Salmon, so no further consultation is required.

Activities described in the Lake Creek Aquatic Habitat Management Plan that may affect the Federally-listed northern spotted owl and marbled murrelet are consistent with the Programmatic Biological Opinion for these species so no further consultation is required.

3. Cultural Resources. No cultural resources have been identified to date in the actual project locations. All required cultural resource reviews will be completed before any project work is undertaken.

4. Wild and Scenic Rivers. None of the rivers in the Lake Creek HMP area were found in the 1995 Eugene District RMP to qualify for further study for designation under the Wild and Scenic Rivers Act.

5. Navigability. The portion of Lake Creek within the project area is not formally designated as navigable. Portions of the river in the project area are occasionally used by recreational boaters using boats, canoes, kayaks or rubber rafts. The most common activity is fishing in Lake Creek below Greenleaf Creek. Because of the limited access points, only a few sections are accessible for boating activity. Low flow patterns and frequent obstacles of boulders and logs also serve to limit use. Boating does occur on Triangle Lake and Hult Pond; this activity would be unaffected by the Proposed Action.

6. Areas of Critical Environmental Concern. Two ACECs are located in the project area. Lake Creek Falls was designated as ACEC on the basis of safety concerns. The continued maintenance of the fish ladder would have no impact on the purpose for the ACEC. The upper Hult Pond ACEC was designated based on riparian/wetland values. The proposed action includes a proposed project for maintenance and restoration of riparian tree species. The proposed project would be consistent with the purpose for the ACEC.

7. Floodplains. The proposed action will have no direct impact on floodplains other than to

improve and maintain the connectivity between the floodplain and the stream system.

8. Invasive Non-native Species. Studies have shown that restoration of aquatic habitat, particularly temperature regimes, reduce the potential for colonization by non-native aquatic species. At present non-native fish species introduced into Triangle Lake have not become established outside the Lake although they have been detected downstream. Restoration activities are expected to reduce the potential for spread of the non-native species. Coordination of project activities with botanists decreases the potential for spread of non-native plant species.

8. State and County Land Use. Aquatic and riparian habitat restoration was found in the District RMP to be compatible with existing State and County land use laws. The proposed actions are compatible with the Coastal Zone Management plans.

9. Permits. All required permits will be obtained prior to the beginning of project work. The majority of restoration activities are less than 50 cubic yards in size, although several potential structures in Lake Creek or Deadwood Creek may exceed 50 cubic yards of fill.

10. Aquatic Conservation Strategy. The proposed action is in compliance with the Aquatic Conservation Strategy as described in the Eugene District RMP and Record of Decision, the Record of Decision for the Supplemental EIS for the Northern Spotted Owl, and the Biological Opinion issued by the National Marine Fisheries Service on 18 March 1997.

BIBLIOGRAPHY

Armantrout, Neil B. 1987. Lake creek Aquatic Habitat Management Plan. USDI Bureau of Land Management, Eugene District, Eugene, OR 27 pp.

Armantrout, Neil B. 1990. Index areas as population indicators. Pp. 71-99, In: Thomas J. Hassler, Ed., Proc. Northeast Pacific Chinook and Coho Salmon Workshop, Arcata, CA. Coop. Fish. Res. Unit, Arcata, CA.

Armantrout, Neil B. 1991. Restructuring streams for anadromous salmonids. Amer. Fish. Soc. Symposium 10:136-149.

Buell and Associates, Inc. 1986. Lake Creek Falls Fish Passage Project. Prepared for USDI Bureau of Land Management, Eugene District, under contract #YA551-CT5-34-0107. Buell and Associates, Portland, OR. 102 pp.

USDA National Forest Service. 1996. Indian/Deadwood Watershed Analysis. USDA Forest Service, Siuslaw National Forest, Corvallis, Oregon, and USDI Bureau of Land Management, Eugene District, Eugene, Oregon. 105 pp, 14 App.

USDI Bureau of Land Management. 1995. Lake Creek Watershed Analysis. USDI Bureau of Land Management, Eugene District, Eugene, OR. 128 pp plus maps and figures.

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APPENDIX A: DISCUSSION OF INDIVIDUAL STREAMS

Settlement in the Lake Creek basin began in the middle of the last century and continues today. Agriculture is common in the Triangle Lake valley and along Lake Creek. Most of the mountainous parts of the basin are managed for timber, with intermingled private and public ownership. Most of the timber is in second growth; active logging continues on private land, but has been reduced on public lands in recent years. The forests on private lands were completely cut over within the past 50 years, and are in younger conifer stands. Federal lands are young to mature, with some old growth.

Streams in the basin were typically filled with large woody material. Harvesting of timber, snagging, splash-damming and stream cleaning have left channels largely devoid of instream structure. The dominant parent material, sedimentary sandstone, produces little cobble-boulder habitat, and limited gravels. The limited boulders and hard gravels are found most commonly near seams created by igneous intrusions, including in Greenleaf Creek and Upper Lake Creek. Because of the limited channel log and boulder structure, channel complexity has been considerably reduced and associated pools, spawning areas, and off-channel habitat are well below potential. Flooding has also contributed to the loss of structure and channel complexity.

UPPER LAKE CREEK

Lake Creek Falls

Lake Creek Falls, just below Triangle Lake, divides the basin into two parts. A large fault block slipped from nearby Elk Mountain into the canyon 43,000 years ago, forming a large lake. Most of the original lake filled in with sediments eroded from adjoining hills, leaving a flat valley. Triangle Lake is the remnant of the originally much larger lake. The Lake Creek Falls area is a half-mile long series of cascades and rapids, with three bedrock falls at the upper end. Two of the falls are passable at very high flows; the third falls is a nearly total barrier to upstream migration of fish. A major highway, highway 36, passes along the north side of the falls area.

The Triangle Lake Valley acts as a water storage basin, reducing downstream flooding and increasing flows during low water periods. Because the water flowing out of the lake is from the sun-heated layer off the top of Triangle Lake, stream temperatures in Lake Creek downstream remains warmer than typical stream flows for much of the year. While this makes the waters more attractive to recreationists it creates a thermal barrier to anadromous fish moving upstream early in the season.

The Falls area is a popular recreation area, particularly the upper end, known as the Slide. The Slide is a flat, sloping bedrock sheet ending downstream at a large pool. The surface of the bedrock sheet develops an algal growth that is very slippery. As the name implies, the bedrock sheet is used as a watery slide. The deep pools and other watery areas are used for diving, bathing and swimming. Because of the potential hazards in the area, it was declared an ACEC in the 1983 and 1995 Records of Decision.

Because of its narrow, steep configuration, the falls area has been subject to periodic landslide activity. Most recently four major slides have occurred that have put logs, boulders and silt into the creek.

With a few exceptions (such as the 1936-42 period when a large log jam formed in the falls), anadromous fish have not been able to penetrate into the Upper Lake Creek basin. In 1989 BLM constructed a fish ladder at Lake Creek Falls. Coho, steelhead and chinook salmon have been documented passing through and spawning above the ladder. ODFW has continued to plant coho and steelhead in and above Triangle Lake to help develop a self-sustaining run of fish in the upper basin.

Triangle Lake

As its name implies, Triangle Lake is a triangle-shaped lake, the remnant of a much larger lake created by the fault block plug that fell into the canyon downstream. The lake covers 279 acres, with a maximum depth over 90 feet and an average depth of 52 feet. The deepest areas are near the outfall. The upper end of the lake, where Lake Creek enters, is a large marshy area. The water level in Triangle Lake fluctuates during the year, as does the size of the associated wetlands. Steep hills border the lake on the other two sides.

The lake receives nutrients from the residential development along the western side of the lake and from upstream. Despite the level of nutrients entering the lake and the limited outflow over the lip of Lake Creek Falls, Triangle Lake is considered to be mesotrophic instead of eutrophic. The lake does undergo annual over-turn, but during the non-mixing periods the hypolimnion becomes anoxic.

The Lake had a native population of cutthroat trout. Beginning in the 1960s the State planted steelhead and coho in and above the lake for rearing. Genetic analysis by the OSU Cooperative Fisheries Unit indicated that some of the steelhead remained in the basin instead of migrating to sea. These steelhead became sexually mature, interbreeding with the native cutthroat, creating a hybrid swarm in much of the lake basin. Some populations of native cutthroat probably persist in the upper basin and perhaps in Triangle Lake. The cutthroat in Triangle Lake, called white trout locally, have the appearance of smolts with only faint spotting even though they do not migrate to sea. The cutthroat from the lake were reported to spawn in July and August, making upstream migrations.

A number of non-native species have been introduced into Triangle Lake, including bass, catfish, perch and bluegill. The sampling by ODFW showed these fish live mainly around the margins of the lake, particularly in the upper part where wetlands and macrophytes provide more suitable habitat. In the center of the lake, the native cutthroat have competition from the introduced kokanee. The kokanee move upstream into Lake Creek and Congdon Creek to spawn, with numbers of spawning fish at times exceeding 25,000 fish.

Triangle Lake Valley

The basin above the falls is characterized by Triangle Lake, the flat alluvial valley, and the surrounding steep hills. A small lake, called Little Lake, is located in an adjoining valley perched above Triangle Lake. Little Lake Creek, which drains from Little Lake into Triangle Lake, is blocked to migrating fish by a culvert. At one time four large mill ponds were found in the upper Lake Creek valley; one on Congdon Creek, one on Schwarz Creek, and two on Lake Creek. Only one remains, the other three having been removed and the pond beds planted to conifers. Hult Pond, the remaining log pond, was created by a 35' earthfill dam across upper Lake Creek.

Where Lake Creek and its tributaries cross the Triangle Lake valley they have cut down into the alluvium, leaving stream channels dominated by dirt banks and soft silt beds. In hillier areas, gradients are steeper, and stream channels typical of western Oregon streams. The transition zones between the steep headwaters and the flat valley have moderate gradients, and contain some of the best spawning habitat on the coast. The dominant geologic type is marine sediments, generally referred to as Tyee sandstone, but there are also a number of volcanic intrusions in the basin that are a source of firmer boulders and gravel.

Nearly all of the Triangle Lake Valley is privately owned, and used for agriculture and residential use. Three small communities, Blachly, Horton and Triangle Lake, are found in the valley. The valley is subject to periodic flooding during periods of high precipitation as groundwater levels rise. The valley once had extensive wetlands and oak forests, and was probably burned at intervals by native Americans. Most of the oak trees have been lost and few are growing to replace them, leaving grasslands and shrub communities in much of the valley.
Above the mouth of Congdon Creek, Lake Creek reaches the upper limit of the flat sedimentary conditions where the stream has incised into the Triangle Lake deposits. Above this point, Lake Creek has a moderate gradient until it nears Hult Pond. The reach shortly below the Hult Pond outlet is steeper, dominated by boulders and bedrock. There are not many pools. Substrates include considerable gravel except near Hult Pond. Lake Creek in this reach flows through the site of a former log pond drained about two decades ago and planted to conifer. Overstory trees are not abundant, and are primarily red alder.

Triangle Lake Tributaries

A number of tributaries, named and unnammed, flow into Lake Creek in the Triangle Lake Valley. Most of these arise of the adjoining slopes and flow for various distances across the valley. They have steep headwaters, only limited transitional zones, and predominance of valley stream habitat. The valley habitat is frequently covered by thick vegetation with limited flows during summer months. Little inventory has been done because most offer limited habitat and are on private lands. They do provide potential habitat for salmonids, particularly coho and cutthroat. Potential for restoration work involves channel structuring and pond developing and would be done in cooperation with private land owners.

Hult Pond

Hult Pond was formed when a 35-foot high earthen dam was constructed across upper Lake Creek in the 1940s. Water flows out of the pond via a spillway that includes a 100 meter long channel and a falls over a concrete lip and a series of large boulders. The pond has an outlet pipe that can be opened to drain the pond, as occurred in 1989 when the pond was completely drained by the then-owner Bohemia.

The pond covers 55 acres, with a maximum depth of 18 feet and an average depth of 10 feet. Deepest areas are near the dam, with an area of shallow water in the middle and upper reaches. At the upper end of Hult Pond, deposits have created a flat delta. Lake Creek on the delta has a very low gradient, and many off-channels and secondary channels. There are extensive associated wetlands, larger in size during winter high flow periods. Substrates are predominantly small gravel, sand and silt. Large woody debris is reasonably abundant. Riparian vegetation includes both older, decadent red alder and big leaf maple, and, in the upper end of the delta, younger red alder. Otter have been seen frequently in the area, and both osprey and bald eagles have been observed using the pond. Many waterfowl visit Hult Pond, and some geese have nested along the edges. However, waterfowl hunting and frequent disturbance by humans limits nesting success.

In the 1964 flood, Lake Creek and its tributaries above Hult Pond sluiced out, leaving a channel with little structure or complexity. The riparian area was removed, to be replaced by a monoculture of red alder. In the delta area at the upper end of Hult Pond, where the valley broadened and the gradient dropped, the flood lost its moment, depositing piles of woody debris. The flood sediment and debris did not extend to Hult Pond, leaving intact thee alder and maple trees immediately above Hult Pond. These trees are much older than the trees upstream disturbed by the flood. Many of the older red alder are becoming overly mature and are starting to die, creating openings in the riparian area. At present, few trees are sprouting to fill these openings.

Lake Creek in this area, influenced by the low gradient and abundant gravels and other sediments washed down from upstream, has created some of the best spawning habitat for coho, chinook and cuttroat trout in the District. The flat gradient and influence of water backed up by Hult Pond has created an extensive wetland area, with abundant aquatic vegetation, large woody cover, and rearing areas for salmonids and other aquatic species. Because of the wetlands, mature riparian area and abundant fish habitat, this area along Lake Creek above Hult Pond was designated as an Area of Critical Environmental Concern in the 1995 Eugene District RMP.

At the time Hult Pond was created, a wooden fish ladder was built at the outlet to provide passage for the “white trout” coming out of Triangle Lake. The ladder did not function well, and gradually collapsed. In 1993 BLM, in cooperation with the Northwest Steelheaders and Willamette Industries, installed a temporary steeppass fish ladder loaned by the Army Corps of Engineers. The ladder successfully passed coho and steelhead. In 1998, BLM replaced the steeppass with a permanent concrete fishway.

Hult Pond contains a population of native trout, in addition to the coho and steelhead that have migrated upstream or been planted by ODFW. A number of summer steelhead have been caught from Hult

Pond, suggesting it is being used by the summer steelhead as a summer refuge area. In addition to salmonids, bass and perch have also been planted in Hult Pond. These centrarchids have been observed annually spawning in the outlet area of the lake where water temperatures are warmer and conditions probably more suitable for building spawning nests.

UPPER LAKE CREEK TRIBUTARIES

Little Lake Creek

Little Lake Creek flows off the Lake Creek-Greenleaf Creek divide directly into Triangle Lake. The name derives from a small natural pond, or lake, through which the creek flows, called Little Lake. Little Lake was formed at the same time as Triangle Lake and has a similar history of filling over time. The remaining Little Lake is shallow, with extensive grassy wetlands around its margins. It is separated from Triangle Lake by a low hill through which Little Lake Creek has cut a narrow canyon. Access for migrating fish from Triangle Lake into Little Lake Creek is blocked by a road culvert in the narrow connecting canyon, although in 1998 or 1999 someone place logs downstream in an apparent attempt to open Little Lake to migrating fish.

Above Little Lake, Little Lake Creek has initially a flat gradient, becoming steeper in the headwaters. The habitat is nearly all pool and riffle, with pools somewhat more abundant. Substrates are dominated by silt and sand, although gravel and small rock are more common in steeper reaches. Woody structure is sparse. Most of the pools are related to channel bends and beavers, which are quite active in the basin. Riparian areas are dominated by alder and big leaf maple, with excellent shading. Banks are more stable in upper areas; in the reaches closer to Little Lake, exposed dirt banks are common, with considerable sloughing and instability in areas once lake that are now filled with deposits.

The lands around Little Lake and downstream to Triangle Lake are privately owner, and are used for pasture and residential purposes. The rest of the basin is managed for timber. BLM-managed lands are mostly in the northern headwater reaches.

Little Lake Creek has resident populations of cutthroat trout and sculpin. Habitat is excellent for coho, and fair for steelhead, with Little Lake offering very good coho rearing habitat. Use by anadromous fish is currently limited by the road culvert. After reviewing fish planting records in the Triangle Lake watershed, ODFW determined no planting is recorded for Little Lake. It is possible that a population of the native cutthroat trout has maintained itself in the Little Lake Basin. The recommendation for Little Lake would be to manage for the native cutthroat trout. Restoration opportunities include bank stabilization around Little Lake and in the lower reaches of tributaries, improving channel structure and diversity in tributaries of Little Lake, and increasing the percentage of conifer in riparian areas. Because of limited access, projects would be best done by hand, or possibly with use of horses or helicopter.

Swamp Creek

Swamp Creek is an extensive drainage with headwaters on the divide with Greenleaf, Lobster, and Congdon Creeks. It flows generally south and east, entering Lake Creek just above Triangle Lake. The lower reaches are privately owned, and used for hay, pasture and residential purposes. Dairy cattle graze along the creek in the lower reaches. There is also a catapault gate on the creek which can be lowered into the channel to flood irrigate adjoining pasture and hay meadows. To date, the gate has not been observed being used during periods of upstream and downstream fish migration. There is at least one small stock pond in the channel for livestock use, but does not appear to block fish. The culvert on the Swamp Creek road is a low water barrier, but fish have successfully migrated above it to spawn. Headwater areas are managed for timber, with extensive areas having been harvested in recent years.

On the Lake Creek floodplain, the stream has the typical incised channel with silty banks and bed. Grassy vegetation is often heavy along the stream, overhanging the channel and helping to stabilize the banks. Where livestock graze, the vegetation is much sparser, and there are areas of exposed bank and erosion. In forested areas, red alder is the most common species, followed by big leaf maple. Douglas fir is sparse in riparian areas, but there are patches with considerable red cedar.

Swamp Creek is dominated by pool habitat, with riffles becoming more common in the intermediate reaches. In the lowest gradient reaches, silt and sand are the dominant substrates, with gravels more abundant upstream in the moderate gradient reaches. Large woody material is very sparse in the lower reaches, but moderately abundant upstream on forested public lands. Pools in the lower reaches are created mostly by stream bends; upstream, plunge and scour pools, many associated with large woody debris are the common pool types.

Coho salmon and steelhead trout have been seen spawning in Swamp Creek. Resident cutthroat and sculpin are also present. The middle portions of the basin have generally good spawning and rearing habitat for salmonids; the lower reaches are more problematic because of the other uses of streamside areas.

Erosion from livestock use has been reduced as a result of fencing by one livestock owner. Maintenance of stream banks and control of erosion would be the primary recommendation for non-forested parts of the watershed. The upper portion would benefit from additions of instream structure to increase pool habitat and channel diversity, and conversion to increase conifers in riparian areas. Access is mixed, with some unmaintained roads paralleling portions of the stream. Access on roads in the upper basin could be re-opened, although alternative methods, such as using horses or creating hand-built structures would be an alternative. Passage at the Swamp Creek road culvert should be evaluated for additional improvements to improve fish passage at all flow levels.

Pontius Creek

Pontius Creek flows eastward off the Lake Creek-Greenleaf divide into Swamp Creek. Its lower reaches, where it crosses the Lake Creek floodplain, resemble Swamp Creek, with dirt banks, incised channel, and adjoining lands used as pasture. As a result of a road and beaver activity, there is fairly extensive wetlands on Pontius Creek. Habitats are nearly all pools or riffles, with the pool:riffle ratio of 3:1. Substrates are dominated by silt and sand, with fair amounts of gravel. Riparian areas on public land are fairly open, with overstory vegetation primarily of red alder and big leaf maple, but with cedar and some Douglas fir. Woody debris is fairly abundant but of small size.

Access for migrating fish has been limited in the past by the road crossings and beaver activity. Coho salmon and cutthroat trout are known to use the stream. Restoration opportunities include improving access, increasing streamside conifers, and improving the amount of cover and channel habitat diversity through placement of structural materials.

Druggs Creek

Druggs Creek is a tributary of Swamp Creek. Its general pattern is similar to Swamp and Pontius Creeks, with a flat section on the Lake Creek floodplain and forested adjoining slopes and headwaters. Ownership is mixed. No inventories have been done in Druggs Creek.

Pope Creek

Pope Creek is a tributary of Lake Creek, entering near the community of Blachly. Lower reaches, where it crosses the floodplain, are typically incised dirt channel lined by vegetation. Public ownership is in the steeper areas with no perennial fish habitat.

Swartz Creek

Swartz Creek heads on the divide between the Lake Creek basin and the Alsea and Willamette River basins in an area referred to as High Pass. It flows in a generally southwestern direction to join Lake Creek. The lower reaches are on the Lake Creek floodplain, so have the typical incised channel with dirt banks and bed. A mill pond once existed on lower Swartz Creek, but has been removed. In the area once occupied by the pond, there is considerable swampiness, with heavy brush and many wet areas. Private land in the lower reaches has the highest density of residential use in the basin, with adjoining lands used as pasture and other agricultural purposes. The majority of the basin is managed for timber.

Main Swartz Creek is nearly all pool or glide; there is little riffle or other flowing water habitat. Substrates in Swartz Creek are heavily dominated by silt and sand.

The majority of the pools are associated with stream bends and beaver. Woody debris is present in moderate amounts, but is predominantly small in size. There is considerable beaver activity, which is reflected in the generally large size of the pools in Swartz Creek. Overall, the pool habitat is generally good quality, with good to excellent coho and cutthroat habitat. Riparian vegetation is sparse in the lower reaches, increasing above residential areas, and is a mixture of alder and big leaf maple, with fair amounts of cedar and Douglas fir. Shading is excellent along much of the creek and its forks. There is a fair amount of bank instability and erosion in the lower reaches.

Swartz Creek is typical coho and cutthroat habitat. Coho, steelhead and cutthroat have been found in the basin along with sculpin and lamprey. Restoration activities are limited on public lands because of ownership patterns. Improved riparian vegetation and channel complexity would improve habitat.

North Fork Swartz Creek

North Fork Swartz Creek is one of two major forks of Swartz Creek. It flows in a generally north-south direction. Much of the private land was logged in 1998 and 1999, and a road along the lower reaches of the creek opened for access then closed again. The canyon is fairly confined except near the mouth with riparian vegetation dominated by red alder. Stream habitat is mainly pool and riffles with sand and silt common. Habitat is fair to good, with coho and steelhead documented. Restoration opportunities include rehabing the stream side road, increasing conifers in riparian and adjoining upslope areas, and increasing channel complexity with placement of wood or boulder structures.

South Fork Swartz Creek

South Fork Swartz Creek parallels the High Pass road along much of its length. It is blocked to fish migration a short distance above its mouth by an impassable culvert on Road 15-6-31. The culvert is adequate for peak stream flows but is unbaffled and has a drop at the end. For a number of years a beaver dam at the upper end of the culvert added a further block, but also created a 3-5 acre wetland. Two other culverts on the High Pass Road 3455 a mile upstream in NE 1/4NE1/4 of Section 31 are also partial to total barriers. Both are small with steep gradient inside the pipe. A fourth culvert on Road 15-6-31.2 is not a barrier, but is a failing log culvert partially collapsed on one end that creates a potential hazard. Road 15-6-31.2 has also had heavy ORV use in its lower reaches that created sediment inflow into South Fork Swartz.

South Fork Swartz in its first mile is flat, depositional unconfined floodplain. It has had extensive beaver activity, although the beavers appeared to have been trapped out in the late 90's. The beaver created excellent rearing habitat for coho and cutthroat although most of it was unreachable for coho. Because of beaver activity trees were sparse along the stream in places, with extensive grass and brush development. Red alder dominate. At the east end of Section 31 where the stream splits into three forks the forks all increase in gradient with a narrowing of the canyon bottom. Riffles and rapids replace larger pools as the dominant habitats.

Restoration activities include addressing culverts in the watershed that are currently barriers, reducing road sediment through rehabilitation or other steps, increasing channel complexity, and allowing beaver to re-establish in the watershed.

Congdon Creek

Congdon Creek is one of the three major tributaries of Lake Creek (the others being Swartz and Swamp Creeks). It enters Lake Creek in 15-7-35, approximately one mile below Hult Pond, near the community of Horton. At one time there was a mill pond on Congdon Creek not far from its mouth, but the pond has was removed some time ago. Headwaters arise on ridges separating the Congdon Creek drainage from Lobster Creek in the Alsea basin, and from upper Lake Creek.

The lowest portion of Congdon Creek crosses the depositional zone of the old Triangle Lake, with typical dirt banks and incised channel. Most of the lower 2 ½ miles flows across depositional materials of moderate slope in an unconfined valley. These conditions have created extensive areas of spawning and rearing habitat suitable for all species of resident and anadromous salmonids. In the upper reaches, the canyons narrow and the gradients increase, with a shift from the pool-riffle habitat of the lower part of the watershed to habitats dominated by rapids and cascades.

Congdon Creek has several major forks and tributaries that share the same habitat pattern of depositional valley in the lower end and steeper gradients in the upper reaches. Together, the mainstem and tributaries provide perhaps the best salmonid habitat in the Upper Lake Creek watershed.

The valley along most of the depositional areas is in private ownership, with several farms and residences. These private lands have narrow riparian areas of trees, mostly red alder, with extensive pastures. The rest of the watershed is managed primarily for forest products, with a mixture of private and public ownership. Riparian areas are dominated by red alder, with some young Douglas fir in the upper half of the stream system. While some patches of older trees remain, most of the forest in the watershed is in younger age classes as a result of past fires and harvest activities. An extensive road network, built for timber management activities, extends throughout the watershed, with a paved road paralleling Congdon Creek.

Since the construction of the fish ladder at Lake Creek Falls, anadromous fish have spawned in Congdon Creek. Coho and steelhead are the predominant users, but chinook have been reported in the lower reaches. In addition, the introduced kokanee in Triangle Lake use Congdon Creek for spawning, with numbers reported by ODFW of more than 15,000 kokanee in one spawning run. Native cutthroat trout are present in Congdon Creek along with sculpins.

The Eugene District in 1982 built several small hand-built rock weirs in the upper part of the watershed. Most did not survive more than two years, but showed that structures in the stream could create good pockets of habitat.

In 1993, BLM joined with ODFW and private land owners in habitat restoration activities in Congdon Creek. Log structures, using mostly alder and small firs, and some boulders, were placed in Congdon Creek. Only a portion of the structures remain seven years later, although these do provide some good habitat. Some riparian restoration was completed at the same time. In addition, Willamette Industries carried out projects on two tributaries in Section 33 that opened passage through impassable culverts, allowing migrating fish to access over two miles of additional habitat.

Potential restoration activities in Congdon Creek include placement of structure in Congdon Creek and tributaries, and increasing the amount and size of conifers in the riparian area. Roads do not appear to have a major impact on the stream system, but should be reviewed for possible improvements. Several culverts block passage of fish on smaller headwater tributaries, and one bedrock area in Section 29 is at least a low water barrier, but no major barriers to anadromous fish migrations have been identified.

Poole Creek

Poole Creek, which enters Lake Creek in 15-7-26, flows off the ridge that separates Congdon and Upper Lake Creeks. It has a low gradient in the unconfined lower reaches, a result of the Triangle Lake deposits, with increasing gradients towards the headwaters. It has excellent spawning gravels and some good rearing habitat, particularly in the middle and lower reaches, with the more typical cascades/rapids in the more confined upper reaches. Riparian vegetation along the lowers reaches is mostly grass and brush. Further upstream riparian vegetation is predominantly red alder.

For many years the undersized culvert on the Lake Creek Road was a barrier to upstream fish migrations. The road fill and raised culvert created an upstream wetland, often augmented when beaver built dams just above the road culvert, raising water to levels where it flowed over the road. In 1998 BLM replaced the culvert with one passable for migrating fish. Upstream habitat is now available to coho salmon and steelhead. Resident cutthroat and sculpin were present in the basin.

Roads 15-7-26.1 and 15-7-26.3 run along side Poole Creek. They have some use from OHV's, which have increased erosion into the creek. In addition, road culverts are barriers to fish movements. Habitat restoration proposed to close and rehabilitate these roads, removing the culverts. As an alternative, one allowing continued use but improving fish habitat, would be to rehabilitate the roads as trails and replace the stream crossings with ones useable by migrating fish. Stream structure improvements and riparian restoration would also benefit the stream, although access limits potential use of heavy equipment unless carried out in conjunction with road de-commissioning.

Lake Creek

Lake Creek goes through a transitional reach beginning a short distance above the mouth of Congdon Creek. This is due to natural landscape patterns and the influence of mill ponds. At the beginning of the reach Lake Creek is still crossings the depositional valley created by the in-filling of the original Triangle Lake. The banks are dirt, the channel is incised, land use is predominantly pasture with only marginal woody riparian vegetation, and with substrates of dirt and organic matter.

Further into the reach the impacts of the former lake diminish as the stream gradient gradually begins to increase. The valley narrows considerably and the channel become more confined. In this more confined reach two mill ponds were built. The lower was removed in the 1970s/80's and the area planted to conifer. The second, Hult Pond, remains in place, controlling the movement of water, sediment and woody material from upstream. A mill also existed between the two ponds in the reach, with remnants of the mill site still present. Toxic materials were detected in the former mill site during a land exchange between the private land owners and BLM, but the detected materials were removed prior to completion of the land exchange that saw transfer of the lands in this reach from private to public ownership.

Lake Creek in this reach shows some variability of habitat, from the silty lower reaches to the rapids/cascades below Hult Pond. Riparian vegetation is dominated by red alder, with considerable brush and some conifer. Stream habitats are generally shallow, with riffles/rapids and glides, although some pool habitat is present.

The lower part of this reach is the upstream limit for chinook observations; there has been no indication of them passing to or over Hult Pond. Steelhead, coho, cutthroat and spawning kokanee have been observed in the reach, mostly in the middle portion. Because of Hult Pond, delivery of channel-building materials is limited. Restoration activities would include placement of structure, increasing conifer in riparian areas, and possibly placement of spawning gravels to substitute for materials now intercepted by Hult Pond.

Upper Lake Creek just above Hult Pond is described in the discussion of Hult Pond.

Above the Hult Pond delta, Lake Creek gradients gradually increase. Headwaters arise on the ridgeline separating the Siuslaw and Alsea River basins. Four major tributaries enter Lake Creek between the upper end of Hult Pond and Neil Creek approximately 1 1/4 miles upstream. Upstream, additional tributaries enter, mostly from the north. Lake Creek eventually divides into three forks.

In the area between Hult Pond and Neil Creek the gradients are moderate and channel moderate to unconfined. Substrates are mostly gravels and boulders, with many riffles and rapids but few pools. The stream diminishes noticeably above Neil Creek, the valley narrows so that Lake Creek becomes moderately to highly confined, and gradients steepen. Substrate particle sizes increase and bedrock becomes much more common. As a result of past flooding, Lake Creek contains almost no woody material. Habitats are created predominantly by boulders, one of the few places in the Siuslaw River basin where boulders are a major factor in the determination of stream habitats.

Riparian vegetation is nearly all red alder, much of dating back to the 1964 flood. The riparian area and adjoining slopes were harvested about the same time, so that most of the trees in the watershed are in younger age classes. As a result of land exchanges in the decade of the 1990s, BLM owns most of the land in the Upper Lake Creek watershed, which is managed under the Northwest Forest Plan and Eugene District RMP.

The watershed contains native cutthroat trout, some of which, in isolated headwater streams, may retain some of the original gene patterns lost downstream as a result of hybridization. Sculpin and brook lamprey were also present, along with a rather sizeable population of giant pacific salamanders. As a result of the construction of the Lake Creek Falls and Hult Pond fish ladders the upper basin is now used by spawning coho salmon and steelhead. While coho are present, habitat conditions are most favorable for steelhead.

In 1997 BLM completed habitat restoration work in Upper Lake Creek, including the placement of boulders and some logs in the creek between the 15-7-35 road bridge and Neil Creek. In addition, patches were opened in the riparian area and planted to conifer as part of riparian restoration. Culverts were subsequently replaced on Neil, Quarry, Hammer and Woody Creeks.

McKay Creek

McKay Creek enters Lake Creek in 15-7-23, at the upper end of Hult Pond. Headwaters arise on the divide with the South Fork Alsea. Its lower quarter mile is wetlands, part of the Hult Pond wetlands. McKay Creek starts at a low gradient on the Hult Pond delta, but then enters a more confined canyon. Gradients increase upstream. There has been considerable beaver activity in the lower reaches, creating a series of ponds and small wetlands. Within the narrower canyon, riparian vegetation is dominated by red alder. Upslope areas are forest with younger age class conifer. Road 15-7-23 through the Hult Pond wetlands parallels McKay Creek for a short distance. It is proposed to close and rehabilitate this road. McKay Creek has not been surveyed for potential project work.

Hammer Creek

Hammer Creek enters Lake Creek in 15-7-14. Its headwaters are off the divide with the South Fork Alsea River. The stream is paralleled by road 15-7-14, an unmaintained road. It has three different characteristics. In the lowest reaches, it has medium to high gradients, with limited pool habitat and substrates
dominated by cobble-rubble-boulder-bedrock. Woody debris is mostly lacking. Immediately next to the stream the riparian is primarily second growth Douglas fir with some red alder.

Approximately one-quarter mile above its mouth, the stream passes an old rock quarry. At this point, Hammer Creek has a short, steep segment, probably formed by passed accumulations of material from the quarry or upstream materials. Above this point, in the second reach, the gradient is low. The valley bottom is filled with accumulated woody material and sediment. The stream flows through the materials, creating a mosaic of riffles and pools. Habitat is very good. Riparian vegetation is mostly brush and red alder.

In the third, uppermost reach the stream gradient steepens, the valley floor narrows, and the stream takes on a typical rapids/cascade characteristic.

Essentially all the Hammer Creek watershed is in younger age classes of second growth conifer.

Hammer Creek was inaccessible to migrating fish until the culvert on the Lake Creek Road was replaced in 1998. Native cutthroat trout were present. Habitat is most suitable for coho and cutthroat.

The primary recommendation for Hammer Creek would be to remove the road 15-7-14. Currently the road is becoming overgrown with alders. The road itself, except in lower reaches, is not an erosion problem, but does interfere with movement of water. Removal would include removal of culverts from tributaries. Some placement of in-channel structure would improve habitat in the first quarter mile.

Quarry Creek

Quarry Creek enters Lake Creek in 15-7-14. Headwaters are off the ridge with South Fork Alsea. The road culvert was a barrier to fish migration until replaced in 1998. Road 15-7-14.2, which runs to a rock quarry, parallels the creek, and is well maintained. Below and immediately above the road culvert, Quarry Creek is riffle dominated, with substrates of cobble, rubble, small boulders and sand. Upstream, gradients steepen, and bedrock becomes more dominant. Near a major forks, the stream passes over several bedrock cascades and falls. The west fork is impassable to migrating fish due to a perched culvert on road 15-7-14.2; upstream 300 meters above the culvert is another series of bedrock falls. The east fork enters a very narrow canyon, and is stair-stepped and steep with several bedrock falls. Most of the woody debris in Quarry Creek was logging debris near the forks. Riparian areas are red alder with some second growth conifer. Upslope areas are dominated by younger age classes of second growth conifer.

In 1997 BLM Undertook habitat restoration efforts in Quarry Creek. With the aid of 3P fallers, trees in the riparian area and in upslope stream influence zone were thinned, with the cut trees dropped so they were in or over the stream channel. Some of the trees were cut so they fell directly into the stream, others were left as bridge logs. Both alder and conifer were thinned. The stream was left to develop natural jams. Several boulder weirs and clusters were placed above the Lake Creek Road culvert as traps for potential material that might otherwise threaten the culvert.

Additional project work was done in Quarry Creek below the Lake Creek Road culvert. Boulders and logs were placed in a series of structures between the culvert and the junction with Lake Creek. Riparian restoration was also carried out, with thinning of alder and planting of conifer.

No additional restoration is proposed at this time other than to maintain and monitor existing riparian and stream restoration activities.

Neil Creek

Neil Creek enters Lake Creek at the western margin of 15-7-14. It arises of the ridge with the South Fork Alsea watershed. Neil Creek is a fairly large watershed. Stream habitat is dominated by riffles, with substrates of cobble, rubble and small boulders. Pool habitat is limited. Upstream, gradients increase slowly to a major forks. Rapids dominate above the forks, with little pool habitat. A road, 15-7-14.1, paralleled the creek, but is now not useable due to debris. Riparian areas are mostly younger age conifer and red alder. Neil Creek shows evidence of at least three flood events. One was probably the 1964 flood, the second some time within the last 15 years (possibly the 1977 or 1982 events), and the most recent in 1996 that nearly washed out the Lake Creek Road culvert. The flood events dumped large amounts of woody debris and sediment onto the Lake Creek flood plain. The stream channel through most of Neil Creek was lacking in large woody material and channel complexity. The watershed is mostly younger conifer, with conifer and red alder in the riparian zone. A major density management harvest/study area, called Ten High, is located in the upper reaches of Neil Creek.

In 1997 the 3P fallers thinned trees, both conifer and red alder, in the riparian and stream influence zones. The trees were felled towards the stream as a source of woody material. Nearly a mile of Neil Creek was treated. A work party from the Albany/Corvallis Trout Unlimted Chapter, together with BLM personnel, cut up many of the downed trees and placed them into selected positions in the stream channel. Other downed trees were left bridging the stream as a future wood source.

In 1998, the culvert on the Lake Creek Road, which nearly washed out in the 1996 flooding, was replaced with a culvert designed to pass fish and other aquatic organisms. Boulder weirs and clusters were placed in Neil Creek above the culvert to intercept wood which potentially could impact the culvert.

Native cutthroat and sculpin are present in Neil Creek. Although the culvert now permits upstream passage of fish none has been documented moving into or spawning in Neil Creek, although monitoring of the stream and project work has been minimal.

No additional channel or riparian restoration is proposed at this time although additional monitoring and evaluation are needed. As part of the NMFS consultation on the Ten High Timber Sale BLM state they would review the roads in the Neil Creek watershed for potential closures of roads.

Upper Lake Creek Tributaries

The third order tributary entering Lake Creek in 15-7-16 is fairly steep, mostly rocky, with limited pool habitats. The best habitat is in the first 250 feet above the road culvert; at this point, there is a bedrock slide that is likely a passage problem. The culvert at road 15-7-16 was replaced in 1998 following flood damage in the 1996 flood. Because of the limited upstream habitat the culvert was not designed for fish habitat although placement of downstream structures would make the culvert accessible to fish. Riparian vegetation includes hardwoods and conifers. No stream or fish inventories have been done in this tributary.

One other culvert, on Road 15-7-35 at the Sect 16/17 line, was also replaced following flood damage in 1996. This culvert was made passable for upstream migrating fish. The stream is third order, with a rapids/cacade/pool habitat types. Habitat is suitable for cutthroat and possibly steelhead.

Several other tributaries in the upper headwaters of Lake Creek are suitable for cutthroat, and possibly steelhead. Access is generally adequate into the tributaries. Steelhead may not be able to reach the area due to a bedrock falls area in Section 15. All the streams are in confined canyons, have variably steep gradients (usually 3-4% or more), are rapids/cascade/pool types, with substrate of gravel, cobble, rubble and boulders. Pools are sometimes deep but usually small in size. Woody material is very limited in size or amount. Adjoining forests are younger age conifer. Riparian includes conifer and red alder. All the streams would benefit from stream structure, of boulders or logs. Roads create some erosion and hydrologic impacts and should be reviewed for possible rehabilitation or closure.

LOWER LAKE CREEK

The reach of Lake Creek between Fish Creek and Lake Creek Falls is in a narrow, confined canyon. Gradients are moderate to steep. Riparian areas have been frequently disturbed and are composed mostly of red alder. Because of steep gradients and lack of structure, the canyon is predominantly rapids and cascades, with an abundance of boulder habitat. At one time, a power diversion dam operated above the falls, sending water through a wood flume to a downstream power house below the falls area for generating electricity. The generator location and segments of the pipe are still present. Several recent landslides have occurred in the canyon area; none have blocked the stream, but they have denuded some of the adjoining hillslopes.

Lake Creek below Lake Creek Falls is a 6th order, low gradient stream flowing through a broad valley. The stream is unconfined by landform but is secondarily confined where it is incised into the valley floor, with the channel usually downcut to bedrock. Because of Triangle Lake there is little delivery of rock or wood from upstream to rebuild stream channels. Fish Creek represents the first such source. Further downstream, increasing numbers of tributaries provide potentially more gravel but structure to retain the materials is lacking. Riparian vegetation varies, but has been mostly removed and the adjoining riparian areas converted to pasture and agricultural use. Banks show instability with some lateral movement of the stream channel at peak flows. Instream structure is lacking, spawning gravel is spotty, and the pools present are often large but shallow and of poor quality.

BLM manages only a small portion of the valley and none of the actual Lake Creek channel below the mouth of Fish Creek. The stream has an exceptional chinook run in the reaches below Lake Creek Falls. In addition, coho salmon, steelhead trout, searun cutthroat trout and Pacific lamprey spawn in Lake Creek. Resident fish, including cutthroat, brook lamprey, sculpin, and other non-salmonids are present although populations vary during the year. On occasion catfish or centrarchids from Triangle Lake are found below Lake Creek Falls, usually in summer, but do not persist. It is also a popular place to catch crayfish. No barriers to fish migration are present, although temperatures often become too high for salmonids in summer months.

Lake Creek would greatly benefit from major improvements in channel structure and complexity using boulders and logs. In addition, potential project activity would include increasing riparian vegetation, especially conifer, and reducing erosion.

A number of tributaries enter Lake Creek in the planning area, with increasing size downstream. These tributaries are important spawning and rearing streams for native salmonids and non-salmonids.

DEADWOOD AND TRIBUTARIES

DEADWOOD CREEK

Deadwood Creek begins on the divide between the Siuslaw and Alsea Rivers, and flows southward to join Lake Creek at the western edge of the planning area. Much of the valley floor is private, and has been converted to agriculture and residential use. The U.S. Forest Service manages most of the non-private land in the western and northern part of the basin. BLM manages only very short reaches of Deadwood Creek in its lower reaches.

Deadwood Creek in the areas of BLM management is a sixth order stream flowing in a broad depositional valley. The stream has incised along much of its length. The substrates include substantial reaches of exposed bedrock. Riparian vegetation has been reduced, and is comprised of limited numbers of alder and big leaf maple, with only a few conifer. Instream structure is essentially absent, and habitat is generally poor with little spawning and rearing area. Water temperatures in most summers exceed levels suitable for salmonids.

Because of its limited ownership, BLM has no real opportunity to conduct independent restoration activities. Deadwood Creek would much benefit from placement of suitable log and boulder structures and an increase in streamside riparian trees, especially conifer. Any work on public lands would be effective only in conjunction with activities on adjoining private lands.

RALEIGH CREEK

Raleigh Creek is a fourth order tributary of Deadwood Creek about five miles above its mouth in 16-8-31. BLM manages most of the drainage. Access to Raleigh Creek is on foot, crossing private land, and wading Deadwood Creek. The lower portion or Raleigh Creek, in private ownership, crosses the Deadwood Creek flood plain. Raleigh has a moderate gradient, with only limited instream structure. It is about 2/3 pool habitat and 1/3 riffle habitat. Pools are mainly lateral scour and trench, indicating the lack of instream structure. The stream, when inventoried, was narrow and shallow, with very little flow. It was dry near its forks. Substrates are a mixture of small rock and gravel, with considerable silt in the pools and quiet water areas. Banks show considerable instability.

Riparian communities are dominated by red alder and big leaf maple, with some cedar and essentially no Douglas fir or hemlock. Average estimated age was 33 years. Shading was in the

good range. Understory vegetation is heavily dominated by salmonberry. Instream woody debris was very sparse, and material present was mostly small in size.

Raleigh Creek has runs of coho salmon, steelhead trout, searun cutthroat and Pacific lamprey, and resident populations of cutthroat trout, sculpin and brook lamprey.

Proposed restoration activities are primarily to increase the amount of structure in the channel to increase habitat diversity and the number of larger, deeper refuge pools. Because of access limitations, hand or horse-built structures would be most suitable. Riparian restoration, involving planting of conifers, would increase the potential for future woody material.

BEAR CREEK

Bear Creek is a fifth order tributary arising on the Deadwood-Greenleaf Divide and flowing southwest into Deadwood Creek in 16-8-30. The lower 2 1/2 miles are on private land, with BLM managing the headwaters area. Because of lack of access, there are no inventories, although there are some observations on spawning activity.

The lower reaches of Bear Creek are low gradient, in an unconfined, broad valley. Much of the land has been converted to agriculture use, with the remaining land in the basin managed for timber. Beaver activity is common, and there is good pool and off-channel rearing habitat. Several structures were placed in the channel as part of an aquatic habitat restoration project by other agencies.

Bear Creek has good runs of chinook and coho salmon, and some steelhead and searun cutthroat trout. No recommendations for restoration have been identified on public lands due to lack of access and information on current and potential conditions.

SOUTH BEAR CREEK

South Bear Creek is a major fork of Bear Creek, entering Bear Creek in 16-8-30, about one-half mile above the junction of Bear Creek and Deadwood Creek. The lower half mile is privately owned; the remainder of the basin is managed by BLM. South Bear flows westerly off the slopes of Windy Peak. Most of the private land is converted to agriculture and residential use; the remainder of the basin is managed for forest-related resources. Steeper areas are generally unstable, with at least one land slide occurring in recent years in an area where no harvest has occurred.

Gradients are generally low except in the smaller, steep headwaters. The valley begins as unconfined, but narrows somewhat in places upstream. The pool:riffle ratio is 2:1, with the two habitat types comprising 95% of the stream habitats. A third of the substrates are sand and silt, but good spawning gravel is present. Woody debris is sparse; 75% of the pools are trench and lateral scour, pool types not created by instream structure. There is considerable beaver activity in some reaches.

Riparian communities are dominated by red alder. Cedar is the most common conifer, with essentially no Douglas fir. Shading is good, and the banks are generally stable. Some logging was done on private land in the mid-1980s, with trees cut to the stream and a temporary road crossing placed in South Bear. Both of these actions contributed considerable silt to South Bear, but the area is now healing.

South Bear has runs of coho salmon, steelhead and searun cutthroat trout. In good water years, chinook salmon will also use the lower end. Cutthroat trout and sculpins are the primary resident fish species.

Access limits restoration activities on public lands, although a cooperative project with private land owners would facilitate restoration activities. On public lands, placement of stream structure and increasing conifer in riparian areas are the primary restoration activities. Hand, horse, or helicopter access could be used for placement of structural materials.

ALPHA CREEK

Alpha Creek is a third order tributary entering Deadwood Creek in 16-8-19 from the east near the settlement of Alpha. It heads off the northern Windy Peak area. No habitat inventories have been conducted, although spawning counts have been done. The lower reaches are private; BLM manages the upper portions of the basin.

Alpha Creek is a moderately steep stream, beginning on the flatter Deadwood floodplain, then entering a more confined canyon. It has spawning habitat and limited pool habitat. Coho salmon and cutthroat trout have been documented using Alpha Creek; steelhead would also find suitable habitat. Local residents have shown an interest in the fish and have provided useful information on the runs. Alpha Creek would benefit from placement of channel structure to increase channel diversity and stability.

ROCK CREEK

Rock Creek enters Deadwood Creek from the east in 16-8-18, flowing west off the Deadwood-Greenleaf Divide. It is a fourth order stream, with basin ownership divided between public and private. BLM manages most of the mainstem but not the headwaters.

Rock Creek is a moderate gradient stream with a 1:1 pool:riffle ratio. Shallow glides are the only other common habitat type. Cobble and rubble are common, with a good supply of gravels. Rock Creek has more woody debris than other creeks in the basin, although pools overall are small.

Riparian communities are mixed alder and big leaf maple; there is almost no conifer. Bank stability is generally good. Instream structure from woody debris is better than in most streams where timber activity has occurred, but is mostly older logging debris.

Rock Creek has runs of coho salmon and steelhead and searun cutthroat trout. Cutthroat trout and sculpin are the primary resident fish.

Access limits potential restoration projects. Rock Creek would benefit from placement of structural material in the channel and plantings to increase conifer in riparian areas.

LAKE CREEK TRIBUTARIES

CHAPPELL CREEK

Chappell Creek enters Lake Creek in 17-8-14. No inventories have been conducted on this stream. The lower reaches are private, with BLM managing the headwaters. In 1995-6 ODFW placed structures in the middle reaches of this stream. Flooding in 1996 caused a major washout just below public lands, with some additional slope failure on public lands. The materials washed downstream creating a log jam and accumulation of sediment and debris. Public lands include some logged and unlogged areas. A riparian buffer was left along the creek, mostly of alder. Habitat on public lands is limited, and useable mainly by cutthroat trout.

WHEELER CREEK

Wheeler Creek enters Lake Creek in 17-8-9.Public lands are limited to about a half mile in the center of Wheeler Creek. No information is available on stream habitat or fish, although riparian areas are mostly red alder. An older, unmaintained road parallels the creek but its impact on Wheeler Creek is unknown.

NELSON CREEK

Nelson Creek is a 5th order stream arising on the western slopes of the Coast Range and flowing in a generally westerly direction before joining Lake Creek near the community of Greenleaf in 17-8-8. Nelson Creek is a classic coho salmon-type stream, with low gradient along most of its length, gravel-sand dominated substrates, and many pools and off-channel rearing areas. Most of the basin is privately owned, with the lower 2/3 of the valley being converted to agriculture and residential use. The rest of the basin is managed for timber by BLM, the State of Oregon and private companies.

The stream in the private pasture areas is often downcut into the substrate, but still retains many of the favorable habitat characteristics. Riparian communities are dominated by red alder and big leaf maple, both on public and private land. Over half a mile of alder was cut in the mid-1980s during a release project in the headwaters on public land, but new alder have replaced the cut trees. In Section 1, the stream is bordered by one of the older hardwood communities; both alder and maple are present, with fewer but larger trees. Shading is good throughout most of the basin. There are few large pieces of woody debris along most of the stream; however, many smaller pieces of alder and maple wood are embedded in the stream. Some of the pieces of hardwoods imbedded in the stream have been in place for at least 15-20 years, and continue to provide good habitat. The generally low gradient, lack of major flooding, and embeddedness of the hardwood debris that keeps it moist year-around probably contribute to its longevity.

Pools are frequent, although not very large in size. They are generally of good quality, with good cover. Beaver activity is common. Nearly half the pools are lateral scour, often associated with stream corners. There are many places where the stream is actively eroding the bank, although it is not considered a problem for fish habitat. During low flow periods in the summer the stream becomes intermittent along many reaches. The pools remain filled, with connecting riffle areas going dry. The pools are generally good refuge habitat, although there is considerable bird and mammal predatory activity on fish in the isolated pools lacking cover.

Several gabions were built in Nelson Creek in 1987.Their current status is unknown. For several years a beaver dam on top of the lower-most gabion flooded out 2 or 3 others upstream, with the dam eventually moving out. While in place it created a large pond that also protected the other gabions. Additional project activity was proposed in the upper portion of the stream but not implemented.

During the decade of the 1970s, a mass movement event from a second order tributary in SE Section

5, 17-7, deposited a large amount of wood debris and sediment in Nelson Creek. An old road crossing downstream on Nelson Creek blocked further movement of the materials downstream. The accumulation of wood, in places, was over 20 feet deep. It created a small lake, which still remains but is gradually filling in. As sediment has filled in around the wood debris, vegetation has grown up, and the area has become quite stable. The wood debris remains a barrier to any upstream fish movements.

Several culverts in the upper reaches prevented upstream migration of salmonids. In 1999 BLM removed or replaced five culverts along the 17-8-14 Nelson Creek Road. Observations in the spring of 2000 indicated coho had spawned in one area formerly blocked by a culvert.

Nelson Creek has runs of coho salmon, and steelhead and searun cutthroat trout. Some chinook also use the stream, particularly in higher water years. Overall, the habitat on public land in Sections 1 and 7 is good to excellent. In Section 5, where the gradient increases and timber management activities more recent, the channel showed some recent degradation due to the lack of instream structure.

Three tributaries of Nelson Creek, McVey, Libre, and an unnamed tributary in Sections 16/21, are large enough to have both resident and anadromous fish. No information is available on any of these streams.

Restoration proposals on public lands are primarily for an increase in instream structure in Section 5. Thinning of adjoining upslope conifer could provide a source of structural material. Horse logging would be a good alternative. Riparian areas are generally good, although active management of existing conifer and additional conifer plantings in upstream areas would help create additional future sources of woody material. The older hardwood riparian areas are showing considerable decadence, with loss of older red alder. Some additional plantings, perhaps of cedar, would benefit these areas.

STEINHAUER CREEK

Steinhauer Creek enters Lake Creek in 17-8-3. Public ownership is limited to the headwaters in both of the major forks. No inventory has been conducted. Steinhauer reportedly has had runs of coho and steelhead, as well as resident cutthroat trout. Riparian areas on public lands are dominated by red alder, but no information is available on habitat or fish. Beginning in 1998-1999 a major lateral slope failure began on private land in 17-8-3/4. During periods of precipitation, large amounts of sediment entered Lake Creek. The sediment has the potential to negatively impact resident and migrating salmonids using public lands, but otherwise has no direct impact on public lands.

GREENLEAF CREEK

Greenleaf Creek is a comparatively large 5th order basin, arising off the Siuslaw-Alsea divide and flowing generally southward to Lake Creek in 17-8-2. It has tributaries off two local prominences, Windy Peak and Elk Mountain. The basin has more magmetic rock than other adjoining basins, which is reflected in the more confined valley floor and greater amount of boulder material. For a basin its size in the Coast Range, Greenleaf Creek is comparatively steep and confined. A major contributing factor is probably its location in one of the most active orogeny zones, as well as the presence of volcanic intrusive material. The stream flows through some of the more unstable terrain in the Coast Range, but does not have many recent mass movements. Visual observations suggest flows are more stable than in other streams, with reduced peak high and low flows.

Greenleaf has less than 30% of its habitat as pool; rapids and cascades each comprise over 10% of the habitats, the only major tributary of Lake Creek that does not have a predominance of pools. Bedrock comprises 18% of the substrate, with boulders making up nearly 17%. This reflects both the greater abundance of boulder material and the faster flows due to gradient and confinement. This is also reflected in the fact plunge pools make up nearly 50% of the pools present. Pools tend to be larger on average, but fairly shallow.

Below the section line at the Section 27/34 line Greenleaf Creek flows onto the Lake Creek flood plain. Here the valley floor widens and the gradient decreases. Most of the lower reaches were partly converted to pasture, and partly recently harvest. BLM acquired most of these lands in an exchange in 1997. Substrates on the floodplain are mostly gravel, with some reaches of excellent spawning material. Available spawning habitat has decreased in recent years due to a lack of structural material to hold the gravels and possibly a reduction in the amount of replacement materials moving down Greenleaf Creek.

Riparian areas have a predominance of red alder, with big leaf maple and cedar being the other abundant riparian species. The riparian width is generally quite narrow for a stream the size of Greenleaf Creek, with some older conifer and hardwood trees. Just above the end of the road in Section 22 is an unusual grove of trees, with large, old growth conifers and some old maple and red alder. Above this grove, the riparian had many more cedar, but about 1980 a permit was issued to harvest the cedar. Most were cut down and sawed into shake bolts; these were never hauled out, although many have floated downstream over the years. Just above the forks in Section 15 there is a remnant old growth cedar grove, one of the very few remaining in western Oregon. Upstream areas have riparian communities of mixed conifer and hardwood, with an abundance of brush species.

Chinook and coho salmon and steelhead and searun cutthroat trout use Greenleaf Creek. Greenleaf is considered one of the best steelhead streams on the coast, and one of the few that probably had a good run of native steelhead prior to the arrival of settlers. At the present time, runs are stopped at a falls in Section 15 caused by a landslide that deposited logs and boulders in the channel. Upstream 1-2 miles is a natural falls that has blocked fish movement; a resident cutthroat trout population is present above this natural falls that was shown to have a unique genetic composition in tests run by the Coop Unit at OSU. These isolated cutthroat also have an unusual color pattern, being very dark to almost black with golden spots along the side. The colors disappear quickly when the fish dies.

At one time coho and chinook salmon did not move upstream past where the road bridge is located in Section 22, although steelhead moved upstream to the first falls. Analysis suggested this was due to a series of bedrock chutes that, at high flows, became velocity barriers. The U.S. Marines in 1984 blasted 13 pools in the bedrock to improve passage; most are still present and functioning. Since that time, coho have been found above this area, but not chinook.

At the same time, two other downstream barriers were removed. One was on private land just below the cascades and tributary in the northern half of Section 34. A log jam had formed on a series of boulders and blocked passage at all but high flood flows, when a side channel opened up. A volunteer crew removed the jam. Two log jams were also located on public land in Section 27. Passage was opened through both of these jams, although part of a gill net was later discovered at one of the openings. Since then, the log jams have gradually broken up and are no longer barriers. Passage is available up to the first falls, although the cascades, at the Section 34/27 line, remain a barrier except during higher flows.

Two sets of gabions were built in Greenleaf Creek in Section 27. One set was designed to move flow away from an actively eroding bank, the other to test a design to increase stream meander. Both gabions functioned well but did not survive more than a few years before breaking apart.

Large woody debris is lacking along most of Greenleaf Creek, although there is some good structure, and potential for more, in those reaches where older trees are present. Timber management activities and the harvesting of cedars have reduced the potential for LWD in the near term, although riparian vegetation is recovering. Beaver activity is nearly absent in the lower reaches of Greenleaf Creek.

Restoration activities are centered on increasing channel structure. Priority would be the recently acquired floodplain lands in Section 35. The stream in this reach has a history of excellent chinook and good steelhead spawning. One reason for declines is thought to be the loss of structure and gravels. Placement of boulder and log structures would be designed to again accumulate gravels. Access is limited above the bridge in Section 22. Several good potential project sites are present above this point. Targeted species would be steelhead and the native cutthroat trout. Because of access problems, it is proposed to use a helicopter to introduce structure into the stream channel.

FISH CREEK

Fish Creek arises on the western slopes of the Coast Range, flowing southwesterly and westerly to join Lake Creek below Lake Creek Falls in 16-7-30. It is a moderate gradient stream with variable valley floor confinement. Except for the lowest half mile, the mainstem of Fish Creek is managed by BLM. The rest of the basin, including tributaries, is a mixture of public and private ownership. The basin is essentially all managed for timber, most of it in second growth. Active harvest continues in the watershed.

Headwaters are steep, arising on the divide between the Siuslaw River and Willamette River basins. Tributaries are typically steep in the upper reaches, go through a short transitional zone, then flatten where they cross the Fish Creek floodplain. One large tributary enters from the north in Section 29. A road parallels most of the length of Fish Creek, with additional roads throughout the basin. The watershed has had a number of major landslide/channel failure events, the most recent in 1996.

Pool:riffle ratio is about 1:1, with some cascades and rapids. Substrates are a mixture of sizes, with over 10% exposed bedrock. Pools are generally of a larger size, but moderately deep. The type of pools present is more diverse than most other Lake Creek streams, including good off-channel and rearing habitat. This is partly due to natural conditions, partly due to extensive beaver activity, and partly due to habitat improvements placed in the stream.

The channel is generally stable, with excellent shading. Some exposed banks are present, mostly in the lowest reaches on private lands where Fish Creek has downcut to compensate for elevation changes in Lake Creek. Some channel cutting occurred during the 1996 flood/landslide event, mostly a result of the dislodgement of natural wood that had stabilized the channel.
Riparian vegetation is mostly young, dominated by red alder and big leaf maple. Some conifers are present, but few of any size. Natural instream woody material is sparse, mostly of a small size. During the 1996 flood, about 20 large naturally-occurring logs, the majority in the lower reaches, were lost from the watershed, decreasing channel stability.

Beginning in 1985, BLM carried out several riparian vegetation restoration projects, primarily underplanting of cedar and other conifer species. Early plantings, without tubing, ended up with little success due to herbivore predation. Later plantings had somewhat better survival, although in a count made in winter, 1994, following a period of cold temperatures and snow, less than 40% of the planted and tubed cedars were still alive.

Two other small projects studied the size of planted trees and brushing impacts on planted trees. In the project looking at of trees, larger, >4 foot tall cedars were planted inside and outside an exclosure. Initially, growth was similar. However, after nine months, hedging became moderate to severe on the plants outside the exclosure compared to those inside, although growth otherwise was similar. In the brushing project, three units were planted, one completely cleared, one partially cleared, the other left uncleared. Fencing for the partial clearing was stolen within two weeks and the trees rapidly eaten. After two years, the survival and growth in the other two were similar. In December, 1994, the survival rate was similar in the exclosures, being somewhat higher in the unbrushed due to the flooding of a portion of the brushed exclosure by a large downstream beaver dam. Growth was better in the brushed exclosure; in the unbrushed, the trees on the margin, where there is more sunlight, had greater growth than those farther in. The results suggest that, for cedar, brushing does improve the growth rate.

In another mixed planting of cedar and hemlock in the lower floodplain, survival was similar, but poor, with both species.

Conifers were planted along access routes and prepared sites followed channel restoration activities in 1995. Trees were tubed with flexible or stiff tubes to reduce browsing. Some trees had mats placed around their bases to reduce competing vegetation. Growth was better among trees with stiff tubing. The flexible tubes often led to the tops of the trees being pulled down and poor tree growth. Matting did initially reduce the growth of competing vegetation, but aggressive control of competing vegetation was needed for both matted and unmatted trees in order to maintain growth.

From the variety of plantings in the fish Creek watershed, several points became clear. The most successful growth occurs where the canopy is opened to provide sufficient light, where brush is actively controlled, and where animal control is practiced. Similar results were obtained at other District planting sites and some Forest Service planting sites in the Siuslaw Basin. In general, three year old trees did better than two year old.

Fish Creek has runs of coho and chinook salmon and steelhead and searun cutthroat trout. For many years, beginning about 1960, the State planted coho and steelhead above Lake Creek Falls for rearing although returning adults were unable to pass over the falls and would seek alternative places to spawn. Because of its proximity to the base of Lake Creek Falls, Fish Creek received an unusual abundance of spawners. The chinook run varied with stream flows; when low, fish spawned in Lake Creek, when flows were high, they move up to three miles up Fish Creek. Steelhead show a similar pattern of response to flows, although not to the same degree as chinook, moving further upstream in years of higher flow. Steelhead, and coho, will pass upstream to the forks at the Section 22/27 line where culverts present barriers to further upstream movement.

Fish numbers in Fish Creek exceeded numbers per mile of most other fish-bearing streams in the Siuslaw basin. Numbers followed the coast-wide pattern, with low numbers in the 1983-84 period, some increase in the later years of the 80's, and a decline in the latter half of the 1990s. Some of these fish were produced in Fish Creek, others were probably from planting of juvenile fish above Lake Creek Falls to help develop the upper basin runs.

Habitat was shown to be spotty in the 1983 inventory. The best habitat was associated with beaver dams in the upper reaches of Fish Creek. Extensive reaches of bedrock reduced the potential for habitat. Stream structure was sparse; where present, larger wood and beavers provided most of the good habitat.

Because of the more abundant returning fish numbers in Fish Creek, the potential for habitat restoration to improve fish production, and the preponderance of public ownership in the basin, BLM in 1983 began an extensive habitat restoration effort in Fish Creek. Initially, in 1984, 23 gabions were placed in Fish Creek. In 1985-1987, additional gabions, alder and fir structures, and boulder weirs were placed in the channel. Placement was predominantly in locations dominated by bedrock. Beavers built dams on many of the projects, creating some quite large pools. Monitoring showed a shift in fish use onto the projects, a pattern that has continued. Some of the projects, particularly those of alder, have broken apart after one or more years. Some of the gabions also began to break apart in the early 1990s, not unexpected since gabions have an average life span of 10 years. The projects continued to retain gravels and other sediments, and create a variety of spawning and rearing habitat.

In 1995, BLM pulled 35 of the original 37 gabions, all but two having begun to fall apart. The gabions were replaced with a variety of log and boulder structures located at the sites as the gabions. During the 1996 flood, the only damage to the new structures was the shattering of a log and the dislodgement of a boulder weir at the uppermost project location. Otherwise, all structures held firm, and accumulated large amounts of sediment and debris.

Numbers of fish have fluctuated, but Fish Creek continues to have one of the highest counts, both in total numbers and fish per mile, of any stream along the Oregon coast, particularly for coho salmon. Spawning habitat is abundant, but collections made by ODFW in 1994 (Beidler, pers. comm.) suggest that available rearing habitat is inadequate for the large number of fry produced. Poaching of fish, particularly chinook, continues to be a problem, both because of the accessibility, and the reputation for numbers of fish.

Beaver, long an important source of habitat, have been trapped out of Fish Creek. Older beaver structures have fallen apart, and no new dams built. The result is a loss of some of the most important rearing habitat in the watershed.

Proposed restoration activities include replacing the large natural logs lost during the 1996 flooding. Since their loss, the amount and quality of spawning habitat available, particularly for chinook, has declined. Additional project locations which would benefit from stream structure were identified in the 1984 Project Plan but were never built; these sites are still suitable for restoration activities. Two culvert replacement projects have been identified; one on the tributary paralleling the 16-7-27.1 road, the other at the 16-7-30 road crossing in Section 22. Riparian restoration opportunities are present at other sites along Fish Creek; priority should also be given to maintaining the existing riparian restoration sites.

APPENDIX TWO: HABITAT TABLES

SUMMARY OF HABITAT INVENTORY INFORMATION FOR LAKE CREEK

The following are tables generated from inventory information collected in the Lake Creek Basin between 1983 and 1992. The information for the Upper and Lower basins are listed separately. The dividing point for the Upper and Lower basins is Lake Creek Falls.

HABITAT INVENTORY IN LAKE CREEK BASIN, 1983-92

STREAM	NO. OF HABITATS	LENGTH INVENTORIED, FT
	UPPER LAKE CREEK	
CONGDON	72	2682
N FK CONGDON	10	134
CONGDON TRIB	10	207
SWARTZ	28	968
E FK SWARTZ	24	571
N FK SWARTZ	11	275
SWAMP	20	767
N FK SWAMP	15	343
N FK SWAMP TRIB	10	136
LITTLE LAKE	15	525
PONTIUS	27	491
UPPER LAKE	76	2972
TOTAL	318	10,071
	LOWER LAKE CREEK	
FISH, 1983	711	28,040
FISH, 1988	553	22,701
FISH TRIB A	11	404
FISH TRIB C	60	1173
FISH TRIB H	71	1055
GREENLEAF	537	28,618
N FK ROCK	56	1064
NELSON	540	15,002
RALEIGH	74	1842
ROCK	328	7963
S BEAR	171	4278
TRIB GREENLEAF	9	211
TOTAL	3123	112,352

Inventories for streams in the Lower Basin were done for extended stream reaches using the District's aquatic habitat inventory procedures. In some of the tables, data for two different dates are shown for Fish Creek. Extensive habitat restoration work was done in Fish Creek in 1984-1986. A second inventory was conducted in Fish Creek to compare conditions before and after the project work.

Inventories in the Upper Basin were conducted only on selected reaches of the streams, using in segments that included 10 individual habitats. These were done by Steven Hurley as part of his M.S. thesis at Oregon State University designed to identify the basic habitat types in the Upper basin and the distribution of fish in relation to the type and quality of habitat present. This study was done prior to the construction of the fish ladder at Lake Creek Falls, and is to serve as a baseline for comparing fish use of the habitat after the ladder became operational.

STREAM HABITATS
LOWER LAKE CREEK

STREAM	POOL	RIFFLE	RAPID	CASCADE	FALL	RUN	GLIDE
FISH, 1983	53.3	30.2	4.3	0.1	0	0.4	9.4
FISH, 1988	44.0	39.2	5.9	2.0	.02	1.5	6.3
FISH TRIB A	3.1	17.0	0	59.0	20.8	0	0
FISH TRIB C	79.2	17.2	0	0	0	0	3.6
FISH TRIB H	28.3	52.8	1.8	4.2	0	0.3	12.0
GREENLEAF	29.4	34.0	11.2	13.2	0	0	10.5
GREENLEAF TR	27.1	72.9	0	0	0	0	0
N FK ROCK	47.6	40.8	0	0	0	0	11.6
NELSON	67.9	19.6	0	0	0	.02	12.5
RALEIGH	67.4	27.2	0	0	0	0	5.5
ROCK	48.2	42.2	0.1	0	0	0	8.5
SOUTH BEAR	66.0	28.9	0.4	0	0	0	5.2
AVERAGE	43.7	33.2	6.5	5.7	.04	1.0	9.3

STREAM HABITATS
UPPER LAKE CREEK

STREAM	POOL	RIFFLE	RAPID	CASCADE	FALL	RUN	GLIDE
CONGDON	64.9	25.4	5.0	0.6	0	0	4.1
CONGDON TRIB	68.8	31.2	0	0	0	0	0
SWARTZ	89.5	4.0	0	0	0	0	6.5

E FK SWARTZ	60.6	37.6	0	1.8	0	0	0
N FK SWARTZ	69.6	21.6	0	0	0	0	8.8
SWAMP	84.6	7.0	0	0	0	0	8.4
N FK SWAMP	71.7	28.3	0	0	0	0	0
TRIB N FK SWAMP	49.4	28.0	0	0	0	0	12.7
LITTLE LAKE	54.2	44.5	0	0	0	0	1.3
PONTIUS	78.5	21.5	0	0	0	0	0
UPPER LAKE	63.0	14.8	20.9	1.3	0	0	0.1
AVERAGE	67.7	19.0	9.7	0.7	0	0	2.9

STREAM DIMENSIONS, FEET
LOWER LAKE CREEK

STREAM	AVE LENGTH	AVE DEPTH	AVE WIDTH	AVE AREA	CHANNEL TYPE PRIM	2ARY	STREAM ORDER
FISH, 1983	39.4	0.83	12.7	593	89%	11%	5
FISH, 1988	41	0.98	15.7	720	89%	11%	5
FISH TRIB A	36.7	2.55	7.0	262	100%	0	4
FISH TRIB C	19.6	0.40	4.1	97	100%	0	3
FISH TRIB H	14.9	0.67	3.9	47	97%	3%	3
GREENLEAF	53.3	1.27	20.3	1180	87%	13%	5
N FK ROCK	19.0	0.25	4.4	91	93%	7%	3
NELSON	27.8	0.56	7.6	265	89%	11%	5
RALEIGH	24.9	0.31	4.4	106	99%	1%	4
ROCK	24.3	0.40	6.9	178	94%	6%	4
S BEAR	25	0.42	8.4	250	89%	11%	4
TRIB GREENLEAF	23.4	0.59	10.8	242	100%	0	4
AVERAGE	36	0.79	12.1	557	90%	10%	

STREAM DIMENSIONS, FEET
LOWER LAKE CREEK

STREAM	AVE LENGTH	AVE DEPTH	AVE WIDTH	AVE AREA	CHANNEL TYPE PRIM	2ARY	STREAM ORDER
CONGDON TRIB	20.7	0.31	4.9	106	100%	0	3
CONGDON	37.3	0.83	12.7	520	99%	1%	5
SWARTZ	34.6	0.67	10.8	453	100%	0	4
E FK SWARTZ	23.8	0.45	7.1	178	100%	0	3
N FK SWARTZ	25	0.39	6	165	100%	0	4
SWAMP	38.4	0.79	8.3	377	100%	0	5
N FK SWAMP	22.9	0.58	7.1	156	100%	0	4

TRIB N FK SWAMP	13.6	0.39	5.2	70	100%	0	3
PONTIUS	34.6	0.67	5	98	100%	0	3
UPPER LAKE	39.1	0.90	13.2	654	100%	0	5/6
AVERAGE	31.7	0.71	9.8	393	100%		

SUBSTRATE, IN PERCENT
LOWER LAKE CREEK

STREAM	BDRK	LRG BLDR	SML BLDR	CBLE	RBLE	LRG GRVL	SML GRVL	SAND	SILT	ORGANIC MATTER
FISH, 1983	16.3	2.2	3.8	6.4	8.8	19.1	10.5	10.9	14.8	7.3
FISH, 1988	12.9	1.7	2.9	7.9	18.7	19.8	9.1	10.3	13.4	3.3
FISH TRIB H	0	0	0.9	0.7	12.3	15.1	11.7	7.2	40.1	11.5
GREENLEAF	18.1	8.7	7.9	9.5	10.0	12.9	7.4	12.2	7.3	5.9
N FK ROCK	0	0	2.7	10.6	14.1	15.4	27.0	24.2	4.2	1.8
NELSON	4.5	0.2	0.7	2.4	8.6	19.8	21.1	23.2	13.7	5.8
RALEIGH	4.4	1.1	2.6	11.5	13.7	13.9	13.6	14.6	24.0	0.6
ROCK	3.3	2.4	5.3	14.5	18.3	16.0	16.8	12.1	8.5	2.9
S BEAR	8.3	1.1	2.8	7.7	11.8	17.7	14.5	23.2	10.7	2.1
AVERAGE	13.6	3.2	4.1	7.4	12.4	18.0	11.0	12.8	12.3	5.3

SUBSTRATE, IN PERCENT
UPPER LAKE CREEK

STREAM	BDRK	LRG BLDR	SML BLDR	CBLE	RBLE	LRG GRVL	SML GRVL	SAND	SILT	ORGANIC MATTER
CONGDON	0.7	1.4	3.9	6.2	8.5	20.7	19.4	20.6	14.5	3.9
TRIB CONGDON	0	0	0	0.5	2.7	24.7	31.9	25.9	7.9	6.5
SWARTZ	0	0	0	0	0	7.8	10.3	25.7	47.2	9.0
E FK SWARTZ	0	0.1	2.5	8.3	10.2	18.8	18.1	25.0	15.5	1.6
N FK SWARTZ	0	0	0	0	0.3	22.9	25.0	26.7	20.1	5.0
SWAMP	0	0	0.1	0.8	0.9	10.8	13.8	31.7	36.1	5.7
N FK SWAMP	0	0	0	0.4	2.4	33.2	26.1	22.9	11.1	3.9
N FK SWAMP TR	0	0	0	0.8	6.5	26.9	22.9	26.0	11.1	5.7
LITTLE LAKE	0	2.6	8.5	10.0	9.2	8.4	9.4	18.5	28.4	5.0
PONTIUS	0	0.1	0.1	0.4	2.8	14.2	17.9	28.5	32.8	3.3
UPPER LAKE	1.2	2.3	7.0	8.6	9.0	7.9	7.4	24.5	20.0	12.1

BDRK - BEDROCK LRG BLDR - LARGE BOULDER SML BLDR - SMALL BOULDER
CBLE - COBBLE RBLE - RUBBLE LRG GRVL - LARGE GRAVEL
SML GRVL - SMALL GRAVEL

POOL TYPES, IN PERCENT
LOWER LAKE CREEK

STREAM	PLUNGE	LATERAL SCOUR	BACK WATER	TRENCH	DAM	2NDARY	ENHANCE	SLOUGH
FISH, 1983	33	24	11	11	11	3	<1	1
FISH, 1988	27	42	2	4	14	7	<1	0
FISH TRIB C	22	44	0	11	22	0	0	0
FISH TRIB H	41	20	6	0	27	0	0	0
GREENLEAF	47	25	10	2	9	5	<1	1
N FK ROCK	4	79	0	12	0	4	0	0
NELSON	1	42	7	27	15	2	0	0
RALEIGH	19	46	0	26	0	0	0	0
ROCK	15	27	1	38	9	0	<1	0
S BEAR	10	25	7	51	2	2	0	0
AVERAGE	25	33	6	16	11	3	<1	<1

POOL TYPES, IN PERCENT
UPPER LAKE CREEK

STREAM	PLUNGE	LATERAL SCOUR	TRENCH	DAM	OTHER
CONGDON	6	59	12	15	0
SWARTZ	18	62	6	12	0
E FK SWARTZ	33	58	8	0	0
N FK SWARTZ	0	100	0	0	0
SWAMP	0	72	0	27	0
N FK SWAMP	0	88	0	0	11
N FK SWAMP TRIP	25	75	0	0	0
LITTLE LAKE	14	57	0	28	0
PONTIUS	31	43	6	18	0

UPPER LAKE	55	29	7	7	10
AVERAGE	26	51	6	11	4

POOL CAUSE, IN PERCENT
LOWER LAKE CREEK

STREAM	BLDR	LARGE WOOD	STREAM BEND	BDRK	BEAVER	DEBRIS TORRENT	FALLS	STRCT	CHNL CHNG
FISH, 1983	20	30	21	0	3	0	0	0	7
FISH, 1988	11	33	24	2	6	1	2	17	<1
FISH TRIB C	15	36	39	0	9	0	0	0	0
FISH TRIB H	44	26	4	0	0	17	0	0	2
GREENLEAF	21	32	20	0	1	2	0	0	<1
N FK ROCK	46	15	26	0	3	0	0	0	3
NELSON	8	33	30	10	6	1	<1	0	3
RALEIGH	4	32	37	2	9	0	0	0	0
ROCK	17	22	26	20	3	1	0	0	<1
S BEAR	10	32	29	12	1	0	<1	0	8
AVERAGE	17	30	24	4	4	1	1	3	<1

POOL CAUSE, IN PERCENT
UPPER LAKE CREEK

STREAM	STREAM BEND	LARGE WOOD	BLDR	FALL	BEAVER DAM	BDRK	CHNL CHNG	OTHER
CONGDON	33	24	17	6	6	2	0	8
N FK CONGDON	0	66	33	0	0	0	0	0
SWARTZ	38	47	0	0	4	0	0	4
E FK SWARTZ	31	37	18	12	0	0	0	0
N FK SWARTZ	66	33	0	0	0	0	0	0
SWAMP	63	9	0	0	0	0	0	27
N FK SWAMP	50	41	0	0	0	0	0	8
N FK SWAMP TRIB	20	80	0	0	0	0	0	0
LITTLE LAKE	57	14	0	0	14	0	0	14
PONTIUS	26	36	21	0	5	0	0	10
UPPER LAKE	15	15	43	5	0	7	0	16
AVERAGE	31	29	19	3	2	2	0	9

POOL DEPTH/WIDTH RATIO, IN PERCENT
LOWER LAKE CREEK

STREAM	0-5	10	15	20	25	30	>35	AVE
FISH, 1983	6	20	29	20	9	5	6	16
FISH, 1988	<1	19	24	26	13	8	7	18
FISH TRIB C	0	7	33	22	11	14	11	21
FISH TRIB H	3	10	10	27	17	17	13	27
GREENLEAF	6	19	33	21	7	8	4	15
N FK ROCK	8	37	33	12	4	0	4	11
NELSON	6	19	26	21	13	4	8	20
RALEIGH	3	13	33	13	23	3	9	19
ROCK	3	20	33	26	14	1	0	14
S BEAR	2	24	38	17	11	1	3	15
AVERAGE	4	19	29	22	11	5	4	17

POOL DEPTH/WIDTH RATION, IN PERCENT
UPPER LAKE CREEK

STREAM	0-5	10	15	20	25	30	<35	AVE
CONGDON	0	6	25	28	21	15	3	19
N FK CONGDON	0	0	0	33	33	33	0	21
SWARTZ	0	6	25	37	25	6	0	17
E FK SWARTZ	0	8	16	41	16	8	8	20
N FK SWARTZ	0	0	0	40	60	0	0	20
SWAMP	0	9	9	36	36	0	9	20
N FK SWAMP	0	0	0	33	16	16	32	28
N FK SWAMP TRIB	0	0	0	25	75	0	0	22
LITTLE LAKE	0	0	0	28	42	14	14	24
PONTIUS	0	0	0	18	25	18	36	33
UPPER LAKE	0	15	45	20	7	7	4	16
AVERAGE	0	6	21	28	22	10	9	21

POOL AREA, IN PERCENT
LOWER LAKE CREEK

STREAM	0-100	200	300	400	500	600	1000	2000	5000	>5000	AVE AREA
FISH, 1983	21	20	9	8	5	3	8	11	6	4	1354
FISH, 1988	14	14	9	8	5	6	14	14	8	4	1111
FISH TRIB C	80	3	11	0	0	0	0	0	0	3	440
FISH TRIB H	92	3	0	0	3	0	0	0	0	0	33
GREENLEAF	9	4	4	4	5	5	13	25	21	7	1860
N FK ROCK	83	8	8	0	0	0	0	0	0	0	53
NELSON	28	17	8	7	4	4	14	10	3	<1	778
RALEIGH	56	26	6	6	3	0	0	0	0	0	108
ROCK	50	23	11	7	2	1	3	<1	0	0	147
S BEAR	39	16	7	2	8	3	13	8	0	0	338
AVERAGE	27	15	8	6	4	3	10	11	8	3	1006

POOL AREA, IN PERCENT
UPPER LAKE CREEK

STREAM	0-100	200	300	400	500	60	1000	2000	5000	>5000	AVE AREA
CONGDON	3	9	9	12	3	12	16	9	22	3	1291
N FK CONGDON	33	33	33	0	0	0	0	0	0	0	137
SWARTZ	0	25	18	0	12	0	24	6	6	6	1012
E FK SWARTZ	50	25	8	0	0	8	0	0	0	0	203
N FK SWARTZ	40	20	20	0	20	0	0	0	0	0	205
SWAMP	9	27	9	9	0	0	0	45	0	0	805
N FK SWAMP	33	44	22	0	0	0	0	0	0	0	157
N FK SWAMP TRIB	75	25	0	0	0	0	0	0	0	0	72
LITTLE LAKE	28	42	0	14	0	0	0	14	0	0	379
PONTIUS	62	12	12	0	6	0	6	0	0	0	174
UPPER LAKE	27	25	7	2	0	5	10	2	7	7	1720
AVERAGE	26	23	10	4	3	4	9	8	7	4	916

RIPARIAN CONDITIONS
LOWER LAKE CREEK

STREAM	PERCENT SHADE	BANK STABILITY EXNT	GOOD	FAIR	POOR	AVE. EST. AGE
FISH, 1983	76					47
FISH, 1988	83	37	21	26	15	49
FISH TRIB H	51					20
GREENLEAF	54					60
N FK ROCK	80	0	16	48	35	80
NELSON	66	3	30	24	42	33
RALEIGH	71	8	33	22	36	33
ROCK	77	30	30	29	11	54
S BEAR	76	45	25	14	15	30
AVERAGE	73	24	25	25	24	47

RIPARIAN CONDITIONS
UPPER LAKE CREEK

STREAM	PERCENT SHADE	BANK STABILITY EXNT	GOOD	FAIR	POOR	AVE.EST. AGE
CONGDON	64	60	16	13	10	24
N FK CONGDON	98	65	10	10	15	24
SWARTZ	88	26	13	19	37	38
E FK SWARTZ	97	20	21	33	25	63
N FK SWARTZ	98	14	23	32	31	30
LITTLE LAKE	90	53	10	13	23	42
SWAMP	48	28	13	29	32	14
N FK SWAMP	91	30	13	13	43	47
N FK SWAMP TRIB	98	60	20	10	10	40
PONTIUS	63	53	7	5	33	31
UPPER LAKE	82	74	2	9	14	33
AVERAGE	77	52	11	15	21	36

RIPARIAN VEGETATION
LOWER LAKE CREEK

	OVERSTORY						
STREAM	ALDER	BL MAPLE	CEDAR	DOUG FIR	HEMLOCK	ASH	GRND FIR
FISH	57	32	2	5	1	0	0
FISH TRIB H	88	<1	4	1	1	0	0
GREENLEAF	60	18	11	3	1	0	4
N FK ROCK	33	41	0	17	10	0	0
NELSON	73	21	<1	4	0	<1	0
RALEIGH	64	21	14	1	<1	0	0
ROCK	56	40	1	3	0	0	0
S BEAR	71	9	15	2	0	0	0
AVERAGE	63	24	5	4	<1	<1	<1

	UNDERSTORY											
	SMB	VMP	ELB	DVC	WLW	BKB	GSB	INP	THB	HKB	HZL	CHR
FISH	19	36	3	2	2	1	1	1	1	<1	<1	2
FISH TRIB H	0	11	11	0	0	77	0	0	0	0	0	0
GREENLEAF	48	21	14	<1	1	<1	0	0	2	2	<1	0
N FK ROCK	42	43	7	0	2	0	0	0	0	0	0	0
NELSON	53	42	<1	<1	2	0	0	0	0	0	0	0
RALEIGH	98	2	0	0	0	0	0	0	0	0	0	0
ROCK	68	16	9	0	0	0	0	0	0	0	0	0
S BEAR	62	28	5	0	<1	2	0	0	0	0	<1	0
AVERAGE	44	31	7	2	2	1	<1	<1	<1	<1	<1	<1

	GROUND COVER												
	GRS	FRN	LDF	SDF	FBS	CTF	OXA	HGN	PGB	HRB	HST	MOS	SDG
FISH	13	14	16	13	10	5	10	5	9	0	1	1	1
FISH TRIB H	14	0	16	8	0	0	0	0	11	0	13	2	0
GREENLEAF	12	0	24	12	0	10	3	<1	2	0	4	4	3
N FK ROCK	0	0	0	0	0	0	0	0	0	100	0	0	0
NELSON	35	35	0	9	12	0	0	4	0	0	0	<1	0
RALEIGH	6	2	0	0	92	0	0	0	0	0	0	0	0
ROCK	2	29	0	0	10	0	0	1	0	56	0	0	<1
S BEAR	7	72	0	0	18	0	0	0	0	0	0	0	0

AVERAGE	15	12	11	11	6	5	4	4	3	3	1	1	1

RIPARIAN VEGETATION
UPPER LAKE CREEK

	OVERSTORY				
STREAM	ALDER	B.L. MAPLE	CEDAR	DOUG FIR	HEMLOCK
CONGDON	78	2	3	13	0
N FK CONGDON	67	33	0	0	0
CONGDON TRIB	18	7	62	0	13
SWARTZ	41	34	6	16	0
E FK SWARTZ	40	38	17	0	3
N FK SWARTZ	51	44	2	2	0
LITTLE LAKE	54	39	6	0	0
SWAMP	60	3	36	0	0
N FK SWAMP	77	20	3	0	0
N FK SWAMP TRIB	50	28	21	0	0
PONTIUS	45	33	14	7	0
UPPER LAKE	87	11	1	1	0
AVERAGE	61	21	9	6	1

	UNDERSTORY								
	SMB	VMP	DVC	WLW	ELB	BKB	HZL	HKB	DGW
CONGDON	50	4	1	3	7	3	2	2	0
N FK CONGDON	100	0	0	0	0	0	0	0	0
CONGDON TRIB	16	32	51	0	0	0	0	0	0
SWARTZ	53	40	0	0	6	0	0	0	0
E FK SWARTZ	11	65	0	0	6	0	0	6	0
N FK SWARTZ	26	73	0	0	0	0	0	0	0
LITTLE LAKE	78	6	0	7	0	0	0	0	0
SWAMP	0	10	0	55	0	0	0	0	0
N FK SWAMP	47	23	29	0	0	0	0	0	0
N FK SWAMP TRIB	95	5	0	0	0	0	0	0	0
PONTIUS	0	44	42	10	0	0	0	0	0
UPPER LAKE	82	6	2	5	0	0	0	0	1
AVERAGE	49	25	7	5	3	1	<1	1	<1

	GROUND COVER											
	FBS	FRN	GRS	SDF	LDF	OXA	SDW	SKC	NTL	THS	HST	ORG
CONGDON	28	25	24	8	0	1	3	0	3	<1	0	<1
N FK CONGDON	43	56	0	0	0	0	0	0	0	0	0	0
CONGDON TRIB	47	26	26	0	0	0	0	0	0	0	0	0
SWARTZ	43	23	30	0	0	0	0	0	0	0	0	0
E FK SWARTZ	12	22	0	21	11	24	0	0	0	0	0	0
N FK SWARTZ	50	50	0	0	0	0	0	0	0	0	0	0
LITTLE LAKE	19	14	30	0	12	0	0	15	0	0	0	0
SWAMP	34	2	52	0	0	2	0	0	0	0	0	0
N FK SWAMP	28	14	28	11	9	5	0	0	0	0	0	0
N FK SWAMP TRIB	0	61	0	0	0	39	0	0	0	0	0	0
PONTIUS	28	0	32	19	19	0	0	0	0	0	1	0
UPPER LAKE	23	38	11	12	10	3	0	0	0	0	0	0
AVERAGE	28	25	20	8	6	5	<1	<1	<1	<1	<1	<1

Overstory species: BLM - Big leaf maple - Acer macrophyllum
DGF - Douglas-fir - Pseudotsuga menziesii
RDA - Red alder - Alnus rubra
WHL - Western hemlock - Tsuga heterophylla
ASH - Oregon ash - Fraxinus oregana
GDF - Grand fir - Abies grandis

Understory Species: BKB - Blackberry - Rubus sp.
CHR - Wild cheery - Prunus sp.
DGW - Pacific dogwood - Cornus nuttallii
DVC - Devil's club - Oplopanax horridum
ELB - Elderberry - Sambucus sp.
GSB - Gooseberry - Ribes bracteosum
HKB - Huckleberry - Vaccinium sp.
HZL - Hazel - Corvius cornuta
INP - Indian plum - Omeleria cerasiformis
SMB - Salmonberry - Rubus spectabilis
THB - Thimbleberry - Rubus - parviflorus
VMP - Vine maple - Acer circinatum
WLW - Willow - Salix sp.

Ground Species: CTF - Colts foot - Petasites frigidus
FBS - Forbs
FRN - Fern
GRS - Grass
HGN - Hedge nettle - Stachys sp.

HRB - Herbs
HST - Horsetail - Equiseum sp.
LDF - Lady fern - Athyrium felix-femina
MOS - Moss
NTL - Stinging nettle - Urtica dioica
ORG - Oregon grape - Berberis sp.
OXA - Oxalis - Oxalis sp.
PGB - Piggy-back - Tolmiea menziesii
SDG - Sedge - Carex sp.
SDW - Sword fern - Polystichum munitum
SKC - Skunk Cabbage - Lysichitum americanum
THS - Thistle - Circium sp.

INSTREAM WOODY STRUCTUR

	LRG BL		SML BL		RT WD		DEBRIS	TYPE, BY %	STREAM		
	$\#/FT^2$	#PCS	$\#/FT^2$	#PCS	$\#/FT^2$	#PCS	$\#/FT^2$	DE	SM	LG	RW
LOWER LAKE CREEK											
FISH	.0006	237	.0027	1046	.0002	82	1182	89	7	1	<1
N FK ROCK	.0165	81	.0536	262	0	0	396	47	40	12	0
NELSON	.0001	11	.0011	144	0	0	248	61	35	2	0
RALEIGH	.0005	4	.0019	14	0	0	220	92	5	1	0
ROCK	.0056	346	.0218	1701	.0002	4	1901	48	42	11	<1
S BEAR	.0003	13	.0009	40	0	0	375	87	9	3	0
TOTAL	.0004	697	.0016	3242	.0001	99	15060	78	16	8	<1
UPPER LAKE CREEK											
CONGDON	.0013	49	.0017	63	.0001	4	1310	91	4	3	<1
SWARTZ	.0010	13	.0027	34	.0001	1	474	90	6	2	<1
E FK SWARTZ	.0028	12	.0040	17	0	0	362	92	4	3	0
N FK SWARTZ	.0039	7	.0028	5	.0006	1	125	90	3	5	<1
SWAMP	.0003	2	.0011	8	0	0	297	96	2	<1	0
N FK SWAMP	.0021	5	.0034	8	0	0	107	89	6	4	0
N FK SWAMP TR	.0101	7	.0072	5	0	0	67	84	6	8	0
PONTIUS	.0011	3	.0053	14	.0004	1	220	92	5	1	<1
UPPER LAKE	.0004	21	.0009	46	.0001	5	990	93	4	1	<1
TOTAL	.0011	131	.0017	208	.0001	12	4204	92	4	2	<1

CODES: LG, LRG BL - Large Bole (12-14" dbh, depending on stream size)
SM, SML BL - Small Bole, (<12-14" dbh, depending on stream size)
RT WD, RW - Root wad (sans bole)
DE - Debris - small pieces of wood

APPENDIX C. SUMMARY OF RECENT PROJECT ACTIVITY

STREAM	LOCATION	DATES	TYPE OF PROJECTS	COMMENTS
		LAKE CREEK BASIN		
Upper Lake Ck	15-7-23	1996	Place log/boulders Riparian restoration	For steelhead
Neil Creek	15-7-14	1996	Thinning/fell trees into stream; boulder weirs	For structure, riparian restoration; Coop. with TU
		1998	Replace culvert with baffled culvert	
Quarry Creek	15-7-14	1996	Thinning/fell trees into stream, boulder weirs	For structure, riparian restoration
		1998	Replace culvert with baffled culvert	
Hammer Creek	15-7-14	1998	Replace culvert	
North Trib	15-7-15	1998	Replace culvert	
North Fork	15-7-16	1998	Replace culvert	
Woody Creek	15-7-13	1998	Replace culvert	
Hult Pond	15-7-26	1992	Steeppass,	Coop. with Willamette Ind., NW Steelheaders
		1998	Constructed fish ladder	Contract
Poole Creek	15-7-26	1998	Replace culvert with bridge	
Congdon Ck.	15-7-20/29	1983	Hand boulder weirs	
	15-7-28,29	1993	Log structures	Coop. ODFW,
	& 33,34		Riparian conversion	Willamette Ind.

	15-7-33	1998	Access to culverts improved	Work by Willamette I. 15-7-34.1 road
Lake Creek Falls	16-7-20	1989	Fishway	3-part fishway
		1996	Repair of flood damage	
Pontius	16-7-7/18	1994	Replace 2 culverts	
Fish Creek	16-7-26/33	1984/5	37 Gabions	SCA, volunteers
			Blasted pools	Marines, BLM
		1985/87	Hand-built wood & boulder structures	SCA
		1995	Replace gabions with log/boulder structures	8A contract
		1985-96	Riparian restoration	
Greenleaf Ck	16-8-22	1984	Blast 12 pools for for passage	Marine Corps project
		1985	Gabions	Flow control
		1984	Open 2 jams; removed key logs	Volunteers Poachers set nets in gaps
Nelson Creek	17-8-11	1985	4 gabions	Youth summer work
	16-8-11,1 replaced	1998,9	Remove 6 culverts,	

APPENDIX D. SUMMARY OF POTENTIAL PROJECTS

STREAM	LOCATION	PROJECT	
Upper Lake	15-7-15,16,17	Small log/boulder channel	structure, riparian restoration.
Neil Creek	15-7-10	Review roads in 10 High as discussed in Consultation.	
Hammer Creek	15-7-14/13	Remove Rd 15-7-14 + culverts	
Upper Lake	15-7-23	Riparian restoration (deciduous decadence)	In ACEC
Hult Pond	15-7-26	Replace bridge over dam outlet	Safety hazard
Poole Creek	15-7-26,27	Remove culverts at Rds 15-7-26.1 15-7-23. Rehab or remove the roads Review for stream structure, riparian restoration.	
Upper Lake Ck	15-7-26	Stream structure, riparian	
Congdon Creek	15-7-33,28,29,30	Stream structure, riparian Road 15-7-33	
	Tribs in Sec.21,29	Stream structure, riparian, Road 15-7-29.2	
	Fks in Sec. 20	Stream structure, riparian	
Swartz Creek	15-6-31	Roads 15-6-31.12, 15-6-31.2 Culverts on Rd 15-6-31, 15-6-31.2 Culverts on Road 3455 Stream structures	
N. Fk. Swartz	15-7-25	Stream structure, riparian Road 15-6-36.1	
Swamp	15-7-31/16-7-6,7	Stream structure, riparian Roads 15-7-31, 15-7-31.3, 16-7-6.1	
Pontius	15-7-25	Stream structure, riparian	
Little Lake	16-8-13	Roads 16-8-24, 16-8-13 Maintain fish barrier to basin	

Cooperate with landowners on projects

Lake Creek Falls	16-7-19,30	Watchable Wildlife trail, displays, habitat project work
Fish Creek	16-7-29,33,27	Culverts on 16-7-30 at trib 16-7-27.1, crossing in Sect. 22 Replace logs lost in flooding Stream structure, riparian projects, maintenance and new. Watchable Wildlife/education trail
Greenleaf	16-8-35	Stream structure East trib culvert
	16-8-27,22,15	Stream structure/helicopter
Nelson	17-8-5	Stream structure, riparian
Raleigh	16-8-31	Stream structure, riparian
S. Fk Bear	16-8-29	Stream structure/helicopter?
Alpha	16-8-20	Cooperative stream structure
Rock	16-8-18,17	Stream structure, riparian

1995 LOG AND BOULDER PROJECT, FISH CREEK

ALDER CANOPY ALONG FISH CREEK

BRIDGE OVER HULT POND OUTLET TO BE REPLACED

HULT POND FROM DAM

UPPER END HULT POND FISH LADDER AT LOW FLOW

TRIANGLE LAKE VALLEY, LOOKING TOWARDS TRIANGLE LAKE OUTLET

LAKE CREEK FALLS, WITH LOWER OUTLET OF UPPER FISH LADDER